HISTORICAL REPORT

AEROMEDICAL FIELD LABORATORY

DIRECTORATE OF ADVANCED TECHNOLOGY
AIR FORCE MISSILE DEVELOPMENT CENTER
Holloman Air Force Base, New Mexico

For Period
1 October - 30 December 1960

The following historical data have been compiled in accordance with AFM 210-1, AFR 210-3, and AFMDCR 210-1. It represents a factual account of this organization during the period indicated.

Hamilton H. Blackshear

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HAMILTON H. BLACKSHEAR
LtCol, USAF, MC
Chief, Aeromedical Field Laboratory

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[illegible] 5
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TABLE OF CONTENTS

COMMAND DATA

1. Organization
    a. Mission
    b. Changes in Organization
2. Strength
    a. Roster of Key Personnel
    b. Chart of Personnel Strength
    c. Personnel Changes

NARRATIVE

1. Progress of Projects and Tasks
    a. Task 68921, "Altered Environments for Biological Specimens"
    b. Task 68924, "Space Vehicle Tests"
    c. Task 68925, "Biophysical Measurements"
    d. Task 68926, "Biological Dosimetry of Ionizing Space Radiations"
    e. ESP 921E-497A-60001
    f. Project 7850, "Biodynamics of Flight"
2. Veterinary Services Branch Support

COMMAND DATA

1. Organization

a. Mission: Develops improved techniques for human factors track testing procedures and instrumentation, determines human physiological tolerance to abrupt deceleration, develops methods and procedures for testing biosatellite capsules and components, maintains adequately conditioned series of animals for all track, chamber and biosatellite test operations, provides pre-and post-test clinical evaluation of test animals, coordinates and directs all biosatellite test programs.

b. Change in Organization: None

2. Strength

a. Roster of Key Personnel

Chief, LtCol Hamilton H. Blackshear, USAF, MC
Assistant to the Chief, Major Edward R. Ziegle, USAF
Technical Advisor, Dr. Harald von Beckh, M.D.
1 Chief, Bio-Astronautics Branch, Major John D. Mosely, USAF, VC
2 Chief, Comparative Psychology Branch, Major Frederick H. Rohles, USAF
3 Chief, Veterinary Services Branch, Capt James E. Cook, USAF, VC
4 Chief, Biodynamics Branch, Capt Eli L. Beeding, USAF, MSC
5 Chief, Administrative Services Branch, Capt Robert D. Hock, USAF

b. Chart of Personnel Strength

		OFFICERS	AIRMEN	CIVILIANS
Beginning of Period	1 Jan 61	21	34	22 — 77
Changes During Period		-2	+4	-1 -5
End of Period		19	38	21 — 78
		30	49	24 = 103

21 December 1961

c. Personnel Changes

ASSIGNMENTS:

TSG Robert A. Renn, Aeromed Tech, 21 Feb 61
A1C Elijah Goins, Lab Spec, 15 Jan 61
A3C Roger M. Barrows, Med Svcs Spec, 13 Feb 61
A3C Booker T. Washington, Lab Spec, 15 Mar 61

78

HIRED:

Mrs. Leonora S. Smith, Secretary, 22 Jan 61
Mrs. Peggy S. Swift, Secretary, 13 Feb 61
Mrs. Martha T. Sappington, Secretary, 19 Feb 61
Mr. Richard F. Chandler, Mech Engr, 19 Feb 61

RESIGNED:

Mr. Richard E. Belleville, Research Psychologist, 27 Jan 61
Mrs. Marguerite E. Shannon, Secretary, 27 Feb 61
Mr. Billy J. Farley, Psychologist, 23 Mar 61

TRANSFERRED:

LtCol Rufus R. Hessberg, Chief, AMFL, 6 Jan 61
Mrs. Helen M. Hughes, Secretary, 15 Jan 61
Capt. Nat G. Bullard, Chief, Admin Svs Br, 1 Mar 61
Miss Virginia A. Fyle, Secretary, 5 Feb 61

NARRATIVE

1. Progress of Projects and Tasks

a. Task 68921, "Altered Environments for Biological Specimens"

Six chimpanzee data acquisition flights were conducted during this report period. These tests are designed to determine the effect of flight vibration and noise on the physiological activity of chimpanzees. Data ~~was~~ were analyzed, computed and assembled from the Temperature Humidity Tolerance Tests for the Scientific Advisory Board meeting. The draft of a Technical Note entitled, "Chimpanzee Temperature - Humidity Tolerance Tests - Control Tests 80° F and 50 % Relative Humidity was approved for publication.

A shipment of plasma and urine was made to the Worcester Foundation for Biological Research, the contractor for "Metabolic Profile Studies of Chimpanzee Blood and Urine", AF29(600)-2499. This shipment contained the series taken from Subject No. 65 before and after the Mercury Redstone shot. A special report was received from the contractor and tentative conclusions are that the stress in the Temperature-Humidity Tests show a distinct separation in the direction of changes in Na, K, Cl. In general, P_{O_4} shows a marked elevation,

b. Task 68924, "Space Vehicle Tests".

The final report was received on contract AF29(600)-2484, "Feasibility and Functional Requirements Study of Certain Portions of a VIDAT System I.

c. Task 68925, "Biophysical Measurements".

Electronic support was provided for five data acquisition flights. Airman Deese and Davies are developing a tape recording system for storage of physiological and environmental data. Telemetry sending and receiving instrumentation equipment is being prepared for solar flare radiation measurement flights scheduled for July.

d. Task 68926, "Biological Dosimetry of Ionizing Space Radiations".

Assembly and check-out of telemetry instrumentation for the radiation detection flights scheduled for this summer has been the major assignment for this task during this report period. Three contracts were monitored and a new contract awarded to the Philco Corporation during this report period.

e. ESP 921E-497A-60001

Aeromed personnel participated in the very successful Mercury Redstone Ballistic shot carrying Chimpanzee No. 65. Several post flights simulating various flight parameters using chimpanzee No. 65 as the subject were conducted at the Aeromedical Field Lab. One of these tests using 100 o_2 at 5 PSI was unsuccessful and it is obvious more preparation and check-out for a test of this type is required.

f. Project 7850, "Biodynamics of Flight".

Ten tests were made on the "Bopper", four indoctrination tests with human subjects at 15G at 1000G/sec and six tests with frogs as subjects. The experiments with frogs ~~was~~ were designed to explore pressure differentials and g parameters in support of the underwater deceleration program. The frogs were placed in a small water filled tank mounted on the Bopper in place of the seat.

Forty-six runs were made on the Daisy Decelerator in support of two weapon system programs, B-58 and F-106. Eleven of these tests

F-106

were to explore human tolerance to impact forces applied to a backward facing 100° oriented subject at 20 g, at 1000 g/sec; five runs with chimpanzee subjects in support of the F-106 program; 20 runs with anthropomorphic dummies as subjects and 11 brake pattern and checkout runs were made without subjects.

2. Veterinary Services Support

a. At the beginning of the quarter, 238 zoological specimens of four different species were in the vivarium.

b. Clinical laboratory support included 40 EKG tracings, 3000 hematology studies, 110 urinalyses, 135 fecal examinations, 182 X-rays, 38 bacteriology studies, 3800 serological determinations and 809 chemistry determinations and 15 TB tests,

c. Histopathology examinations included 602 microscopic slides. Seven autopsies were performed.

d. Physiological base-line studies are being made on 39 young apes.

e. A variety of base-line biochemical assays one micro-amounts of biological fluids of chimpanzees were accomplished.

f. In the biochemical laboratory 809 serum, blood and urine biochemical determinations were made. Most of these determinations have been performed with micro-analysis instrumentation on biological fluids. Approximately 15 various biochemical determinations are being performed by these micro-methods, using less than 0.1 ml. of blood or serum for each individual determination.

TABLE OF CONTENTS

COMMAND DATA

1. Organization
    a. Mission
    b. Changes in Organization
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    b. Chart of Personnel Strength
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    a. Task 68921, "Altered Environments for Biological Specimens"
    b. Task 68924, "Space Vehicle Test"
    c. Task 68925, "Biophysical Measurements"
    d. Task 68926, "Biological Dosimetry of Ionizing Space Radiations"
    e. ESP 921E-497A-60001
    f. Project 7850, "Biodynamics of Flight "
2. Veterinary Services Branch
3. Meetings
4. Visitors

COMMAND DATA

1. Organization

a. **Mission:** Develops improved techniques for human factors track testing procedures and instrumentation, determines human physiological tolerance to abrupt deceleration, develops methods and procedures for testing biosatellite capsules and components, maintains adequately conditioned series of animals for all track, chamber and biosatellite test operations, provides pre-and post-test clinical evaluation of test animals, coordinates and directs all biosatellite test programs.

b. **Changes in Organization:** None

2. Strength

a. **Roster of Key Personnel**

Chief, Lt Col Rufus R. Hessberg, USAF, MC
Chief, Biodynamics Branch, Lt Col Hamilton H. Blackshear, USAF, VC
Assistant to the Chief, Major Edward R. Regis, USAF
Technical Advisor, Dr. Harald von Beckh, MD
Chief, Bio-Astronautics Branch, Major John D. Mosely, USAF, VC
Chief, Comparative Psychology Branch, Major Frederick H. Rohles, USAF
Chief, Veterinary Services Branch, Capt James E. Cook, USAF, VC
Chief, Administrative Services Branch, Capt Nat. C. Bullard, USAF

b. **Chart of Personnel Strength**

	OFFICERS	AIRMEN	CIVILIANS
Beginning of Period	22	37	22
Changes During Period	+2 -2	+5-3	+4-2
End of Period	22	39	24 = 85
	+1	+3	+5 +3

c. **Personnel Changes**

ASSIGNMENTS:

Capt Freda Herrera (WAF), R&D Staff Assistant, 1 Oct 60

A2C Edward Graff, Specialist, 1 Oct 60
A3C Charles Deese, Scientific Aide, 5 Oct 60
SSMGT James Ferguson, Aeromed Supt, 10 Oct 60
Capt Vernon Carter, Vet Off, Gen, 26 Oct 60
A2C Joseph Collins, Courier, 20 Nov 60
SSMGT Howard Blackburn, Vet Supt, 1 Dec 60

HIRED

Mr Fred W. Staten, Bio-Chemist, 10 Oct 60
Miss Virginia A. Fyle, Secretary, 11 Oct 60
Mrs Marguerite E. Shannon, Secretary, 30 Nov 60
Mrs Betty A. Batchik, Secretary, 5 Dec 60

DISCHARGED

Capt Eldon Miksch, Vet Off, Gen, 1 Oct 60
Lt Phillip Darling, Avn Physiologist, 15 Dec 60
A2C James Brous, Courier, 25 Oct 60

RETIREMENT

MSgt Lee Pierce, Vet Tech, 31 Dec 60

RESIGNED

Mrs Arlene S. Ratton, Secretary, 10 Nov 60
Mrs Frances M. Gesford, Secretary, 24 Nov 60

REASSIGNED

A2C John Ritts, Scientific Aide, 30 Nov 60

1. Progress of Projects and Tasks

a. Task 68921, "Altitude Environments for Biological Specimens"

Eight in-flight chimpanzee tests were conducted during this period. These tests are designed to determine the effects of flight vibration and noise on the physiological activity of chimpanzees. Eight thermal humidity tests were conducted this report period. These tests are intended to establish optimum, minimum and maximum tolerable temperatures at various relative humidities for young restrained chimpanzees. It is interesting to note the variation in tolerance to specific temperatures and relative humidities recorded during these tests:

Date	Temperature	Relative Humidity	Duration	Animals (Nr)
22-23 Sep	70 Degrees	50%	20 hrs	1
29-30 Sep	80 Degrees	50%	20 hrs	1
13-14 Oct	80 Degrees	50%	20 hrs	1
8-9 Nov	100 Degrees	50%	11 hrs	2
15 Nov	100 Degrees	50%	2 hrs 10 min	2
2 Dec	90 Degrees	50%	3 hrs	1
8-9 Dec	85 Degrees	50%	20 hrs	2
16 Dec	90 Degrees	50%	2 hrs	1

Three contracts were monitored for this task; AF 29 (600)-1530, University of California, on the "Analysis on Plasma and Urine from Human Subjects Under Physiological Stress;" AF 29 (600)-2439, Worcester Foundation for Biological Research, on "Metabolic Profile Studies of Chimpanzee Blood and Urine;" AF 29 (600)-2017, University of California, on "Oxygen and Carbon Dioxide Toxicity in Mice and Monkeys," was complete.

b. Task 68924, "Space Vehicle Test"

An exhibit and necessary documentation to procure a VIDAT System I was completed.

c. Task 68925, "Biophysical Measurements"

Eight physiological data acquisition flights were flown this report period. Drawings and diagrams were completed to place physiological data on tape during chamber experimentation. Work to fabricate this system has begun.

d. Task 68926, "Biological Dosimetry of Ionizing Space Radiations"

The flight data recorded during the balloon flights at Bemidji, Minnesota, last summer was reduced and delivered to the University of Chicago for analyzing.

The University of Chicago developed a detection system which was delivered. A request for a determination and findings was approved by ARDC for development of a Space Radiation Monitoring System. A pre-proposal conference was held 19 December 1960. Nine companies have indicated interest in submitting proposals for this system.

A proposal and plans were submitted for solar radiation experimentation during the summer of 1961.

e. ESP 921E-497A-60001

Daisy and Long Track runs were conducted simulating parameters that will be encountered in Project Mercury animal program flights.

The Project Mercury MR-2 Countdown was revised to reflect experience gained using the Mercury vans during the chamber test conducted at Cape Canaveral.

f. Project 7850, "Biodynamics of Flight"

Forty-two runs were made on the Daisy Decelerator; runs 13 human subjects, 5 animal and 24 dummy. One run with an animal subject was for Project Mercury. The animal subjects were dogs having visualized organs. Radiographs were taken using the micronex X-Ray machine to determine the effects of acceleration and deceleration on the internal organs of the subject.

The runs with a human subject were to test the efficacy of the chest protector to be used by the experimental jumper in the Convair "B" Ejection Seat Tests. Data obtained from these runs have deemed the protector adequate.

Work was terminated on Contract AF 29 (600)-1815, "Fluid Filled Capsule" and Contract AF 29 (600)-2084, "Sled Borne Oscillator."

Specifications were written to establish a Shock Testing Facility and the procurement of a sled borne telemetry system.

2. Veterinary Service Support

a. At the beginning of the quarter, 272 zoological specimens of four different species were in the Vivarium.

b. Clinical laboratory support included 117 EKG tracings, 2500 hematology studies, 94 urinalysis, 144 fecal examinations, 225 X-Rays, 42 bacteriology studies, 4,000 serological determinations and 500 chemistry determinations.

c. Histopathology examinations included preparation of 493 microscopic slides.

d. General items of interest are:

1. The mouse colony was given to the School of Aviation Medicine, Brooks AFB, Texas.

2. Primates were examined an restrained each day, for the Comparative Psychology Branchs' training program which totaled about 487 tests for the quarter.

3. Ten autopsies were performed.

e. A variety of base line biochemical assays on micro-amounts of biological fluids of the chimpanzee was a notable achievement this report period.

3. Meetings

The Surgeon General's Research Council Meeting was held at the Aeromedical Field Laboratory 8 through 9 December 1960.

4. Visitors

Dr Almadjian, the principal investigator for Contract AF 29 (600)-2439, Worcester Foundation for Biological Research, made a one hour verbal presentation on the results achieved, at a seminar held at the Laboratory 10 Novemeber 1960.

A representative from Gulton Industries spent two weeks during the report period in the Instrumentation Laboratory aligning and calibrating the physical data acquisition system for future flights.

2-7-6

HISTORICAL REPORT
AEROMEDICAL FIELD LABORATORY

DIRECTORATE OF ADVANCED TECHNOLOGY
AIR FORCE MISSILE DEVELOPMENT CENTER
Holloman Air Force Base, New Mexico

For Period
1 July 1960 - 30 September 1960

The following historical data have been compiled in accordance with AFM 210-1, AFR 210-3, and AFMDC 210-1. It represents a factual account of this organization for the period indicated.

RUFUS R. HESSBERG, Lt Colonel, USAF, MC
Chief, Aeromedical Field Laboratory

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Data Cards 0

TABLE OF CONTENTS

COMMAND DATA

1. Organization
   - a. Mission
   - b. Changes in Organization
2. Strength
   - a. Roster of Key Personnel
   - b. Chart of Personnel Strength
   - c. Personnel Changes

NARRATIVE

1. Progress of Projects and Tasks
   - a. Task 68921, "Altered Environments for Biological Specimens"
   - b. Task 68924, "Space Vehicle Test"
   - c. Task 68925, "Biophysical Measurements"
   - d. Task 68926, "Biological Dosimetry of Ionizing Space Radiations"
   - e. ESP 921E-497A-60001
   - f. Project 7850, "Biodynamics of Flight"
2. Veterinary Service Support
3. Comparative Psychology Support

COMMAND DATA

1. **Organization**

a. Mission: Develops improved techniques for human factors track testing procedures and instrumentation, determines human physiological tolerance to abrupt deceleration, develops methods and procedures for testing biosatellite capsules and components, maintains adequately conditioned series of animals for all track, chamber and biosatellite test operations, provides pre and post-test clinical evaluation of test animals, coordinates and directs all biosatellite test programs.

b. Changes in Organization: None

2. **Strength**

a. Roster of Key Personnel

Chief, Lt Col Rufus R. Hessberg, USAF, MC
Chief, Biodynamics Branch, Lt Col Hamilton H. Blackshear, USAF, MC
Assistant to the Chief, Major Edward R. Regis, USAF
Technical Advisor, Dr Harald von Beckh, MD
Chief, Bio-Astronautics Branch, Maj John D. Mosely, USAF, VC
Chief, Comparative Psychology Branch, Maj Frederick H. Robles, USAF
Chief, Veterinary Services Branch, Capt James E. Cody USAF, VC
Chief, Administrative Services Branch, Capt Nat C. Bullard, Jr, USAF

b. Chart of Personnel Strength

	OFFICERS	AIRMEN	CIVILIANS
Beginning of Period	21	36	21 = 78
Changes During Period	0	+2 -1	+7 -6
End of Period	21	37	22

c. Personnel Changes

ASSIGNMENTS:

A3C John Ritts, Scientific Aide, 5 September 1960
A3C Thomas Fry, Physiological Training Specialist, 15 September 1960

HIRED:

Mr Sidney W. Cook, Summer Aide, 5 July 1960
Mr Robert M. Schmidt, Summer Aide, 5 July 1960
Mr William Hicks, Summer Aide, 5 July 1960
Mr John H. Coley, Summer Aide, 5 July 1960
Mrs Arlene Ratton, Secretary, 15 September 1960
Mrs Leona Mitchell, Scientific Illustrator, 27 September 1960
Mr Billy J. Farley, Psychologist, 27 September 1960

TRANSFER:

A2C Gilberto Diaz, Medical Specialist, 4 September 1960
Miss Ada V. Wester, Scientific Illustrator, 21 August 1960

RESIGNED:

Mrs Melva R. Shaw, Secretary, 19 August 1960
Mr Sidney W. Cook, Summer Aide, 15 September 1960
Mr Robert M. Schmidt, Summer Aide, 30 August 1960
Mr William Hicks, Summer Aide, 15 September 1960
Mr John H. Coley, Summer Aide, 15 September 1960
Mr Billy J. Farley, Summer Aide, 15 September 1960

1. Progress of Projects and Tasks

a. Task 68921, "Altered Environments for Biological Specimens"

Five in-flight chimpanzee tests were conducted during this report period. These tests are designed to determine the effects of flight vibration and noise on the physiological activity of chimpanzees. The physiological parameters are recorded on board and will eventually be telemetered to a receiving station on skin and rectal temperature on GSR, EKG, temperature and respiration rates,

Three contracts were monitored for this task; "The Analysis on Plasma and Urine from Human Subjects Under Physiological Stress", AF 29(600)1530 with the University of California; "Oxygen and Carbon Dioxide Toxicity in Mice and Monkeys", AF 29(600)2017 with the University of California; and "Metabolic Profile Studies of Chimpanzee Blood and Urine", AF 29(600)2439 with the Worcester Foundation for Biological Research.

b. Task 68924, "Space Vehicle Test"

A contract, "Feasibility and Functional Requirements Study of Certain Portions of a VIDAT System I", AF 29(600)2482, was awarded to the Armour Research Foundation. The principal investigator, Dr. Shizuo Hori, and members of his staff observed techniques of monitoring an instrumented chimpanzee at the Aeromedical Field Laboratory, 1 - 5 August.

c. Task 68925, "Biophysical Measurements"

The Physiological Data Acquisition System Maintenance contract was renewed for the remainder of the fiscal year. In-flight chimpanzee tests were conducted. Balloon telemetry transmitter and ground and airborne telemetry receiving stations were prepared for balloon flight support. Instrumentation was recorded for thermal humidity tolerance tests duplicating conditions that will be encountered on future Project Mercury animal flights.

d. Task 68926, "Biological Dosimetry of Ionizing Space Radiations"

Radiation detection instrumentation was flown on four balloon flights which reached altitudes ranging from 130 to 140 thousand feet. Ground and airborne telemetry receiving stations were prepared. Telemetry transmitting equipment and Aeromedical Field Laboratory personnel were transported to Bemidji, Minnesota, the launching point. Flight data reception was checked periodically and excellent data was received and recorded. The Analysis and Computation Division will reduce the data recorded on magnetic tapes during these flights.

Contracts monitored for this task were: "The Feasibility Study for the Development of a Space Radiation System", AF 29(600)2049, which was completed; "Development, Scanning and Analysis of Nuclear Emulsions", AF 29(600)2025, with New Mexico State University;

"Development of a Primary Cosmic Rary Counter", AF 29(600)2361, with the University of Chicago; "Development of Balloon Borne Small Cosmic Particle Detector Instrumentation", AF 29(600)2361, with the Lockheed Missiles and Space Division; "Controls for Radiation", AF 29(600)2340.

The cosmic radiation detection instrumentation was so successful an exhibit has been prepared entitled, "Space Radiation Monitoring System". A pre-initiation conference was held prior to preparation of a purchase request and the necessary documentation for submission of a Determination and Findings to the Secretary of the Air Force for review and approval. Requests for proposals will probably be sent out the middle of October.

e. ESP 921E-497A-60001

Environmental tests of the animal flight couch were conducted at McDonnell Aircraft Corporation, St Louis, Missouri. The results of these tests showed that further testing by the Aeromedical Field Laboratory is necessary to determine post impact chimpanzee thermal humidity tolerance levels. Successful animal runs were made on the Daisy and Long Track simulating parameters that will be encountered on actual suborbital and orbital flights.

Higher Headquarters directed the Laboratory to train seven veterinarians and 24 veterinary technicians for the Project Mercury Animal Recovery Program. One veterinarian and four technicians arrive at the Laboratory on a TDY basis every two weeks for instruction in the care and management of chimpanzees under any post flight condition.

f. Project 7850, "Biodynamics of Flight"

A purchase request was submitted for a high G, flat top, multipurpose sled for use on the long track. Specifications have been written for procurement of a Shock Tester and its associated electronic equipment and an 18 channel FM/FM telemetry package. Work is continuing on long track support and instrumentation.

A total of 17 Daisy Decelerator runs were made during this period. Nine were brake patterns development runs and eight were human runs in the backward facing position. These runs were to determine the ability to hold the subjects head in a specific position during higher velocities. These tests included the first human run with the new air-gun propulsion device.

2. Veterinary Service Support

a. At the beginning of the quarter, 297 zoological specimens of four different species were in the vivarium.

b. Fifteen young chimpanzees were picked up at Yaounde, Cameroun, West Africa, and flown to the Laboratory 22 August.

c. Clinical laboratory support included 65 EKG tracings, 1238 hematology studies, 79 urinalysis, 81 fecal examinations, 197 X-rays, 73 bacteriology studies and 10 blood chemistry studies.

d. Histopathology examinations included 562 microscopic slides and 17 autopsies.

e. Base-line physiological data is being compiled for establishing normals for comparison.

f. The biochemistry laboratory performed 115 serum and blood determinations.

g. In addition to knowledge concerning amplitude to internal relationships on the electrocardiograms, studies are being made concerning the rhythm variations, normal variations in QRS axis, T-waves and effects of age, body size and emotional stress.

h. The greatest accomplishment during this report period was the initiation of a variety of base-line biochemical assays on fluids of the immature chimpanzee.

3. **Comparative Psychology Support**

a. Chimpanzees were trained on the avoidance task for the first two Project Mercury Flights. A total of 1080 hours training was conducted for this phase. Animals who became proficient in this training were further trained for the last two Project Mercury Flights. Twelve animals are trained for flights one and two and six of these are being trained for flights three and four. Four animals were sent to Wright Air Development Center for adaptation to increased gravitational forces. This data was analyzed and reports written entitled, "Acceleration-Deceleration Studies of Project Mercury Chimpanzees: Behavioral Effects of Simulated Redstone Launch".

An Ampex portable recorder is being used to record the animal's performance in the Laboratory in the same manner as it would be recorded during flight.

An animal was subjected to acceleration tests on the Long Track and Daisy Decelerator, however, the analysis of this data is not completed.

Larger animals, not suitable as subjects for space flight, were tested to determine the processes for measuring higher intellectual processes. The oddity technique was used; the subject had to select the odd stimulus in a three stimulus situation in which two of the stimuli were alike and one was different. Under a 19 to one ratio schedule, one subject made 3000 discriminations in 56 minutes with eight errors.

b. Contracts monitored this quarter were: "Development of a Closed Environmental System", AF 33(616)6639 with General Electric Dorporation; The contract with the University of Kentucky, AF29(600)2039 to train chimpanzees will be terminated as soon as the final report is received; "Perceptual Monitoring System for Primates", AF 29(600)2308 with the Grason Stadler Company. Animals are being procured for requirements in the contract "Methods for Controlling Animal Behavior in Space Environments", AF29(600)2418, with Texas Technological college.

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RUFUS R. HESSBERG, JR., Lt Colonel, USAF, MC
Chief, Aeromedical Field Laboratory

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TABLE OF CONTENTS

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1. Organization
    a. Mission
    b. Changes in Organization
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    a. Roster of Key Personnel
    b. Chart of Personnel Strength
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b. Changes in Organization: None

2. Strength

a. Roster of Key Personnel

Chief, Lt Col Rufus R. Hessberg, Jr., USAF, MC
Chief, Biodynamics Branch, Lt Col Hamilton H. Blackshear, USAF, MC
Assistant to the Chief, Major Edward R. Regis, USAF
Technical Advisor, Dr Harald von Beckh, MD
Chief, Bio-Astronautics Branch, Major John D. Mosely, USAF, VC
Chief, Comparative Psychology Branch, Major Frederick H. Rohles, USAF
Chief, Veterinary Services Branch, Captain James E. Cook, USAF, VC
Chief, Administration Branch, Captain Nat G. Bullard, Jr., USAF

b. Chart of Personnel Strength

	OFFICERS	AIRMEN	CIVILIANS
Beginning of Period	21	34	21
Changes During Period		+2	+3 -3
End of Period	21	36	21

c. Personnel Changes

ASSIGNMENTS:

TSgt Per Fohlstrom, Lab Technician, 9 May 1960

HIRED:

Mrs Janie G. Wardlow, Secretary, 20 June 1960
Mr Billy Joe Farley, Summer Aide, 23 June 1960
Mrs Dorothy L. Fletcher, Secretary, 26 June 1960

TRANSFER:

Mrs Ethel M. Driskill, Secretary, 20 June 1960

RESIGNED:

Mrs Eunice Hugoniot, Laboratory Technician, 4 April 1960
Mrs Janie G. Wardlow, Secretary, 30 June 1960

1. Progress of Projects and Tasks

a. Task 68921, "Altered Environments for Biological Specimens"

The following three contracts were monitored: (1) AF29(600)1530, University of California, on the analysis on plasma and urine from human subjects under physiological stress; (2) AF29(600)2017, University of California, on oxygen and carbon dioxide toxicity in mice and monkeys; and (3) AF29(600)2439, Worchester Foundation for Biological Research, on metabolic profile studies of chimpanzee blood and urine. These contracts are continuing and progress is satisfactory.

The primary in-house efforts have been thermal-humidity tests and in-flight chimpanzee tests. The thermal-humidity tests are designed to establish the humidity and temperature tolerance limits for chimpanzee specimens. The eleven tests made were successful. The in-flight chimpanzee tests are designed to determine the effects of flight vibration and noise on the physiological activity of chimpanzee specimens. Several physiological parameters such as temperature, GSR, EKG, respiration, are recorded on board the aircraft and telemetered to the receiving station at the Aeromedical

Field Laboratory. The eight tests accomplished were successful.

b. Task 68924, "Space Vehicle Test"

The primary activity in this task has been contractual in nature and has been concerned with the development of a VIDAT (Viability Data Acquisition) System. The exhibit has been written for this system and proposals have been received and evaluated from several potential contractors. Armour Research Foundation, Chicago, Illinois, has been selected to perform the VIDAT Design Study.

c. Task 68925, "Biophysical Measurements"

The contractual efforts accomplished under this task have been limited to the renewal of the maintenance contract on the Physiological Data Acquisition System developed for the Aeromedical Field Laboratory by Gulton Industries. The main effort of this task has been in-house and has been directed primarily towards the support of Task 68921, in which the thermal-humidity and the in-flight chimpanzee tests are accomplished and also in support of Task 68926, in which space radiation detection balloon flights are programmed. In addition, Task 68925 has also provided instrumentation and electronic support for the Comparative Psychology Branch and the Veterinary Services Branch.

d. Task 68926, "Biological Dosimetry of Ionizing Space Radiations"

The contractual efforts under this task have consisted of the monitoring of five contracts. These contracts are: (1) AF29(600)2049, Lockheed Aircraft Corporation, on a feasibility study for the development of a space radiation detection system, (2) AF29(600)2025, New Mexico State University, on the development, scanning, and analyzing of nuclear emulsions, (3) AF29(600)1759, University of Chicago, on the development of a primary cosmic ray counter; (4) AF29(600)2361, Lockheed Aircraft Corporation, on the development of a space radiation detection system; and AF29(600)2340, Controls of Radiation, on the relative biological effectiveness study of energetic particulate radiations. Work under all these contracts has progressed satisfactorily. The efforts under Contract AF29(600)2049 have been completed and the final report is being prepared. The radiation detection equipment developed under both contracts AF29(600)1759 and AF29(600)2361 has been completed and the balloon flights under which these detection devices will be flown are programmed for late June and early July. The primary in-house efforts under Task 68926 have been directed towards those activities necessary to accomplish high altitude balloon flights from a northern latitude on which the newly developed radiation detection devices will be flown. Originally these balloon flights were scheduled to be conducted from Prince Albert, Canada during the latter part of May and June. However, the clearance necessary to accomplish these flights from Canada was disapproved and it has been necessary to alter the arrangements and launch balloon from northern Minnesota. These flights are now scheduled to occur in late June and July.

e. ESP 921E-497A-60001

Vans to support animal test activities at WADD and McConnell Aircraft Corporation and actual animal flight activities at Wallops Island and Cape Canaveral were delivered fully equipped to WADD on 25 May.

Simulated flight centrifuge runs were successfully conducted the week of 20 June at WADD. Transverse G, vibration and acoustical noise parameters were simultaneously tested. Eight Aeromedical Field Laboratory personnel participated in installing instrumentation as well as conducting actual test runs.

Arrangements are nearing completion for Daisy and Long Track animal runs to simulate parameters to be encountered on actual sub-orbital and orbital launch and following re-entry during parachute opening and water impact.

An additional testing program was conducted to test the efficiency of the Mercury Astronaut head restraint device during simulated flight conditions. These tests were successfully conducted on the "Bopper."

f. Project 7850, "Biodynamics of Flight"

B-58 capsule tests were made while a Stanley Aviation representative was here. Twenty tests were made using the modified Daisy Sled Nr. 2 and a simulated B-58 capsule. Basically, these tests were to determine harness loads generated by simulated ejection and crash conditions on the B-58 integrated harness. Dummy movement was also determined photographically. The force attenuation characteristics of the pre-loaded integrated harness were also compared with a non pre-loaded standard T-33 harness.

Two human runs were made at low G level to obtain data on dummy-human force reading correlation. Results indicate that the restraint ability of the B-58 integrated harness is reliable when the seat pan is in the up-ejection position. When the seat pan is not in the up-ejection position the restraint ability is poor due to the lack of an inverted "V" strap.

Three runs were made in an attempt to develop a high frequency accelerometer amplifier, galvanometer reporting system. These tests were moderately acceptable.

Twenty-one tests were made on the new air-powered Daisy Decelerator Propulsion Device. This included 10 bona-fide acceptance tests per specifications of contract AF29(600)1494. The tests were successful in all aspects. Contract specifications as to velocity, reproduceability, cyclic rate and accelerative force and rate of onset were easily met.

Three subject indoctrination runs were made on the "Bopper." Two runs were successful and one unsatisfactory for medical reasons.

The Mercury astronaut suit helmet was tested beginning at a subject level of 7 G and working up to the 15 G level. Eight human subject runs were made with the subject wearing the helmet chin strap. Subjective and photographic evidence of unsatisfactory head movement within the helmet was sought. No unsatisfactory movement was noted.

Baseline EKG studies were made utilizing new EKG lead placements (sternum, T-8, L-5) with 13 human runs made to obtain dynamic baseline

EKG's. This lead placement proved to be amazingly successful, as it permits obtaining a clinically significant EKG for the entire run with the exception of one beat at impact.

2. Veterinary Service Support

a. At the beginning of the quarter, 171 zoological specimens of five different species were in the vivarium.

b. Clinical laboratory support included 50 EKG tracings, 834 hematology studies, 212 urinalysis, 53 stool examinations and 134 X-rays.

c. Histopathology examinations included 1205 microscopic slides and 109 autopsies.

d. The biochemistry laboratory did 104 serum cholesterol and chloride studies. Eighty/six urine samples and 24 blood serum samples were done for steriod studies.

3. Comparative Psychology Support

Major effort has been training chimpanzees in support of ESP 921E-497A-60001 the past three months. The animals have received a total of 1077 training hours during this period. Success was considerable in this training and time required to obtain proficient performance was considerably reduced.

Exploratory research work was conducted with larger chimpanzees in perceptual monitoring chambers. The performance of a chimpanzee who had to select the odd stimulus in a 3 stimulus interval in which 2 of the stimuli were alike and one was different was outstanding. Working on a fixed ratio schedule in which it was rewarded with a pellet of food for every 19th correct discrimination, this animal made 3000 responses in 56 minutes with only eight errors. Research was also started with Java monkeys who were placed in operant conditioning chairs and trained on a variable interval operant conditioning schedule.

Equipment received during this period and with the apparatus constructed locally, makes the Comparative Psychology Branch one of the finest facilities of its type in the country.

Four contractual efforts were handled during this reporting period. Contract AF33(600)6639 with the General Electric Corporation, called for the development of a closed respiration system for monkeys. All items of this contract were picked up by military aircraft in Philadelphia and were set up in Building 1266. A 100-hour engineering acceptance test of this system was conducted with a large chimpanzee. All combinations of the following pressures, temperatures, and humidity were used. (Pressure 14.7, 10 and 5; temperature in degrees fahrenheit, 95, 75, 55, and relative humidity, 70%, 50% and 30%. The system worked very well and a final report of this test was received in June 1960.

Training of immature chimpanzees for possible use in biosatellite flights continued at the University of Kentucky under contract AF29(600)2039. Drs. Lange and Clarke, principal investigators on this contract, visited the Branch and Dr. Belleville, contract monitor, visited the University of Kentucky to supervise a film production by APGS at the University. A supplemental agreement was prepared for this contract for the immediate return of two of the four animals currently at Lexington and for the remaining two to continue training for an additional 60 days. No additional funds were required for this supplemental agreement.

Work continued on the perceptual monitoring system for primates which is being built by the Grason-Stadler Company under Contract AF29(600)2308.

In April, Dr. Belleville and Mr. Owens visited Texas Technological College, Lubbock, Texas to negotiate a contract entitled, "Methods for Controlling Animal Behavior in Space Environments." This contract was signed on 17 May 1960. Dr. Richard E. Belleville is the contract monitor and Dr. Sylvan J. Kaplan is the principal investigator. The equipment that the government will furnish under this contract was sent to Lubbock by government vehicle.

Captain Zinser, a reservist on active duty during this reporting period was assigned to collect data for the design of the work space layout for chimpanzees.

HISTORICAL REPORT
AEROMEDICAL FIELD LABORATORY

DIRECTORATE OF ADVANCED TECHNOLOGY
AIR FORCE MISSILE DEVELOPMENT CENTER
Holloman Air Force Base, New Mexico

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For Period

1 January 1960 - 31 March 1960

The following historical data have been compiled in accordance with AFM 210-1, AFR 210-3, and AFMDC 210-1. It represents a factual account of this organization for the period indicated.

RUFUS R. HESSBERG, JR., Lt Col, USAF, MC
Chief, Aeromedical Field Laboratory

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Chronolog 0
Data Cards 0

TABLE OF CONTENTS

COMMAND DATA

1. Organization
    a. Mission
    b. Changes in Organization
2. Strength
    a. Roster of Key Personnel
    b. Chart of Personnel strength
    c. Personnel Changes
3. NARRATIVE
    1. Progress of Projects and Tasks
        a. Project 7850, "Biodynamics Flight"
        b. Project Mercury
    2. Veterinary Service Support
    3. Contract Status
    4. Visitors

COMMAND DATA

1. Organization

a. Mission: Develops improved techniques for human factors track testing procedures and instrumentation, determines human physiological tolerances to abrupt decelerations, develops methods and procedures for testing biosatellite capsules and components, maintains adequately conditioned series of animals for all track, chamber and biosatellite test operations, provides pre and post-test clinical evaluation of test animals, coordinates and directs all biosatellite test programs.

b. Changes in Organization: None

2. Strength

a. Roster of Key Personnel

Chief, Lt Col Rufus R. Hessberg, Jr., USAF, MC
Chief, Biodynamics Branch, Lt Col Hamilton H. Blackshear, USAF, MC
Assistant to the Chief, Major Edward R. Regis, USAF
Technical Advisor, Dr Harald von Beckh, MD
Chief, Bio-Astronautics Branch, Major John D. Mosely, USAF, MC
Chief, Comparative Psychology Branch, Major Frederick H. Rohles, USAF
Chief, Veterinary Services Branch, Captain James E. Cook, USAF, VC
Chief, Administration Branch, Captain Nat G. Bullard, Jr., USAF

b. Chart of Personnel Strength

	OFFICERS	AIRMEN	CIVILIANS
Beginning of Period	21	26	20
Changes During Period	0	Plus 8	Plus 3-2
End of Period	21	34	21

c. Personnel Changes

ASSIGNMENTS:

A/3C George Pegram, Scientific Aide, 3 January 1960
A/3C Sherwood B. Browning, Scientific Aide, 5 January 1960
A/3C Michael Berman, Vet Spec, 10 January 1960
A/2C Ronald Svihovec, Adm Clerk, 15 January 1960
A/2C James L. Brous, Courier, 20 January 1960
SSgt Henry Fegley, Inst Spec, 25 February 1960
A/1C Rudolph Davies, Inst Spec, 18 March 1960
A/1C Joe Pace, Vet Spec, 29 March 1960

HIRED:

Mrs Helen Hughes, Secretary, 8 February 1960
Mrs Ruth Sitzer, Secretary, 23 February 1960
Miss Jessie Miller, Librarian, 14 March 1960

RESIGNATIONS:

Mrs Ruth Sitzer, Secretary, 23 March 1960

DEATHS:

Miss Hulda Henderson, Librarian, 9 January 1960

1. Progress of Projects and Tasks

a. Project 7850, "Biodynamics of Flight"

A total of 60 runs were made on the Daisy Decelerator. Acceleration and strain gage data were obtained from 17 dummy runs using B-58 harness and capsule. Excessive spinal G (vertical) readings were considered significant. Fifteen human runs were conducted in the forward facing position. These runs outlined the area in which the limit of human tolerance can be expected, which is 30-35 G on the sled and 35-40 G on the subject. The highest subject level formed was 39.8G (XYZ resultant) on Run 675. The subject on this run suffered three vertebrae factures and transient electrocardiographic abnormalities. Six dog runs were made with animals possessing radio-opaque organs. Micronex X-rays were made to correlate organ displacement with subject and sled deceleration patterns.

b. Project "Mercury"

Chimpanzees received training on a concurrent discrete and continuous avoidance task. This training can be divided into essentially two stages; the first phase used conventional laboratory-type restraint systems and response manipulanda. After the subject became proficient in this phase, the second phase began. This consisted of training the animals in flight couches which had configurations similar to those that will be used during the actual flight. During the second phase, the flight couch with its animal occupant was placed in capsule mock-ups supplied by McDonnell Aircraft Corporation. Training is being conducted with non-flight eligible chimpanzees to determine a procedure for measuring higher intellectual processes. The purpose was to develop in the animal the concept of "odd" in a three stimulus situation in which two of the stimuli were alike and one was different. In the best performance to date, a single animal made only two errors in 360 trials.

2. Veterinary Service Support

a. At the beginning of the quarter, 296 zoological specimens of four different species were in the vivarium.

b. Clinical laboratory support included 87 EKG tracings, 742 hematology studies, 295 urinalysis, 380 stool examinations and 120 X-rays. Histopathology examinations included 430 microscopic slides.

c. In direct mission support of the Laboratory 15 autopsies were performed and 32 autopsies were performed for other purposes.

d. Experimental surgery included implants of accelerometers on sternum of one zoological specimen, minor corrective surgery on one zoological specimen and minor surgical intervention on two zoological specimens previously exposed to specialized radio-opaque injection techniques.

e. Technical reports are being prepared on 234 base-line blood samples. Electrocardiograms are being evaluated to determine the feasibility of preparing a technical report. All normal or base-line physiological data is being compiled for establishing normals for comparison to study on post mission subjects.

f. Temperature and humidity tolerance studies on chimpanzees have provided 18 blood serum samples and 180 urine samples for steriod studies.

3. Contract Status

a. A contract with the Miami Rare Bird Farm, Miami, Florida was let for 24 young apes. Twenty specimens were delivered but only 18 were acceptable under the procurement contract.

b. Purchase requests were initiated for an extension of track length for the Daisy Decelerator and for a new high-G multipurpose sled for the Captive Missile Test Track. A contract for a new water brake for the Daisy Decelerator was signed.

c. Three acceptance tests on the "Subject-Carrying Water Filled Capsule" were made on the Captive Missile Test Track. One additional acceptance test remains to be run.

d. Contract AF 29(600)-2308 for a Perceptual Monitoring Task for Primates was signed with the Grason-Stadler Company, West Concord, Massachusetts.

4. Visitors

a. Mr Earl Younger, McDonnell Aircraft Corporation, delivered a prototype water dispenser for inspection and test and a prototype model of the stimulus display to be used in Project Mercury.

b. Lt Col James Henry form NASA visited to discuss problems related to the Laboratory support in the Mercury Project.

c. Others visiting the Laboratory were Mr Boyden Bush, Space Task Group, Langely Field, Virginia; Mr Donlon, Associate Director, Project Mercury; Lt Col Stanley White, Chief, Life Sciences Branch, Space Task Group; Dr Robert Voas, Chief Psychologist in charge of training the "Astronauts," Space Task Group, Langely Field, Virginia, and Mr Rodney Iwan, McDonnell Aircraft Corporation.

HISTORICAL REPORT
AEROMEDICAL FIELD LABORATORY

DIRECTORATE OF ADVANCED TECHNOLOGY
AIR FORCE MISSILE DEVELOPMENT CENTER
Holloman Air Force Base, New Mexico

For Period

1 October 1959 - 31 December 1959

The following historical data have been compiled in accordance with AFM 210-1, AFR 210-3, and AFMDC 210-1. It represents a factual account of this organization for the period indicated.

Rufus R. Hessberg Jr.
RUFUS R. HESSBERG JR., Lt Col, USAF, MC
Chief, Aeromedical Field Laboratory

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Data Cards 0

TABLE OF CONTENTS

COMMAND DATA

1. Organization
    a. Mission
    b. Changes in Organization

2. Strength
    a. Roster of Key Personnel
    b. Chart of Personnel Strength
    c. Personnel Changes

NARRATIVE

1. Progress of Projects and Tasks
    a. Project 7850, "Biodynamics of Flight"
        (1) Task 78503, "Tolerance to Impact Forces"
        (2) Task 78504, "Tolerance to Total Body Pressure Change"
        (3) Task 78505, "Tolerances to Ram Pressure and Thermal Effects"
        (4) Task 78506, "Patterns of Deceleration in Space Flight"

    b. Project 6892, "Biomedical Test and Techniques for Advanced Vehicles"
        (1) Task 68921, Altered Environments for Biological Specimens"
        (2) Task68924, "Space Vehicle Test"
        (3) Task 68925, "Biophysical Measurements"

2. Veterinary Services Support

3. Psychology Support

4. Trips

5. Visitors

6. Buildings

COMMAND DATA

1. Organization

a. Mission: Develops improved techniques for human factors track testing procedures and instrumentation, determines human physiological tolerances to abrupt decelerations, develops methods and procedures for testing biosatellite capsules and components, maintains adequately conditioned series of animals for all track, chamber and biosatellite test operations, provides pre and post-test clinical evaluation of test animals, coordinates and directs all biosatellite test programs.

b. Changes in Organization: None

2. Strength

a. Roster of Key Personnel

Chief, Lt Col Rufus R. Hessberg, Jr., USAF, MC
Chief, Biodynamics Branch, Lt Col Hamilton H. Blackshear, USAF, MC
Assistant to the Chief, Major Edward R. Regis, USAF
Technical Advisor, Dr Harald von Beckh, MD
Chief, Bio-Astronautics Branch, Major John D. Mosely, USAF, VC
Chief, Comparative Psychology Branch, Major Frederick H. Rohles, USAF
Chief, Veterinary Services Branch, Captain James E. Cook, USAF, VC
Chief, Administration Branch, Captain Nat G. Bullard Jr., USAF

b. Chart of Personnel Strength

	OFFICERS	AIRMEN	CIVILIANS
Beginning of Period	18	26	19
Changes During Period	Plus 3	Plus 3-3	Plus 2-1
End of Period	21	26	20

c. Personnel Changes

ASSIGNMENTS:

Lt Col Hamilton H. Blackshear, Medical Officer, 14 October 1959
A/2C Ronald Quimby, Physiological Tng Specialist, 1 October 1959
A/3C Robert Corkery, Physiological Tng Specialist, 1 October 1959
A/2C Nicholas Skames, Instrumentation Specialist, 30 October 1959

HIRED

Sylvia Echavarria, Secretary
Nancy Schwandt, Secretary
Najla Bonahoom, Secretary

DISCHARGES

A/2C Alton Yates, Supply Specialist, 18 October 1959
A/2C William DuBose, Courier, 10 December 1959
A/3C Glayden Clark, Instrumentation Specialist, 15 December 1959

RESIGNATIONS:

Najla Bonahoom, Secretary, 31 December 1959

1. Progress of Projects and Tasks

a. Project 7850, "Biodynamics of Flight"

(1) Task 78503, "Tolerance to Impact Forces": The new Coleman sled, number 3, arrived and acceptance tests performed. Human rate of onset studies with subject in backward facing position were begun, programmed at 15g at 2000 g/second. The subjects did not experience any difficulties. AF 29(600)-1662, "Intra-lumen Pressure Transducer" with Gulton Industries supports this task. Transducers were delivered and tested during this report period. The tests revealed the transducers to be unsatisfactory.

(2) Task 78504, "Tolerance to Total Body Pressure Change": American Machine and Foundry Company are supporting this task. Delays

in completing a contract with this company and the steel strike have delayed the delivery of the device for measuring tolerance to body pressure changes until February 1960. Acceptance tests will be done at Holloman rather than at the American Machine and Foundry Company as previously planned.

(3) Task 78505, "Tolerances to Ram Pressure and Thermal Effects"

The design phase of the oscillating capsule was discussed. It is apparent that the performance limitations imposed by the structural and dynamic design parameters involved is seriously cutting into the usefulness of the oscillator. It has been decided to finish the design phase and thoroughly study the program before funding any future work on the oscillator.

(4) Task 78506, "Patterns of Deceleration in Space Flight:"

Problems in testing this device for additional tolerance to high G loadings were solved. Captain Beeding and Lt Zaborowski immersed themselves in the swimming pool with a breathing apparatus and instrumentation which is used in actual G loading runs. A test was made using a dummy subject. The telemetry and on-board recorder circuits failed during the test and the dummy was forced into the foot end of the capsule, however, the capsule and sled system withstood the test satisfactorily. After the first test of the water filled capsule, available data was analyzed and preparations were made for a second test with the capsule orientation at 90 degrees to the track.

b. Project 6892, "Biomedical Test and Techniques for Advanced Vehicles"

(1) Task 68921, "Altered Environments for Biological Specimens"

The 0_2 toxicity studies on mice have been completed and studies on monkeys are in progress. The hypoxia studies have not been started. Thermal tests were conducted and excellent metabolic data were obtained. The Laboratory borrowed a thermal chamber from the Guidance and Control Division and the Ecology Section installed the necessary physiological recording instrumentation. In two tests where temperature was maintained at 80°F and 50% humidity, excellent metabolic data were obtained. In two later tests where the temperature was maintained at 90°F and 50% humidity, it was necessary to abort the tests after only a few hours duration. Rectal temperatures, respiration rates, and heart rate became elevated to a dangerous level, and it is believed that some importance should be given to the fact that the animals struggled excessively while instrumentation was being attached. An informal progress report was received on "Human Metabolic Profile Studies of the Effects of Environmental Stresses". All biochemical analyses have been completed. The data is being transferred to IBM punch cards. To avoid bias in the interpretation of the data the Contractor has not been furnished any information with respect to specific environmental stresses imposed on the various subjects.

(2) Task 68924, "Space Vehicle Test"

Masters describing count-down procedures for MARK II were corrected for a Technical Note. A draft was prepared for a Technical Note describing the testing of USE 133 and 152.

(3) Task 68925, "Biophysical Measurements"

Equipment for instrumentation of this task was delivered in December. Acceptance tests are continuing and preliminary findings have been satisfactory. Plans now are to conduct acceptance tests in airborne aircraft. Cosmic ray data obtained in balloon flights in Minnesota in August were reduced with excellent information obtained. Nuclear emulsion plates flown on these flights were developed and partially analyzed. The Operations Section continued support for the mission of the Laboratory by constructing specific physiological measuring devices and installing and calibrating other physiological recording devices.

2. Veterinary Services Support

a. At the beginning of the quarter, 244 zoological specimens of 4 different species were in the Vivarium.

b. Chimpanzees are issued daily for classified studies.

c. Eighteen young chimpanzees were accepted under procurement contract from the Miami Rare Bird Farm, Miami, Florida.

d. Clinical laboratory support included 12 EKG tracings, 170 hematology studies, 63 urinalysis, 86stool examinations and 20 X-Ray, 689 microscopic slides were made for histopathology examination.

e. Biochemistry laboratory support included 110 serum cholesterol and chloride studies. Temperature and humidity tolerance studies on chimpanzees included 10 blood serum samples and 100 urine samples for steroid studies. Plans are to expand the biochemistry support to include 17 Keto-steriod tests.

f. Base-line physiological data is being compiled for establishing normals for comparison study.

3. Psychology Support

a. Chimpanzee training was emphasized this quarter. A total of 983 training hours was expended on chimpanzees. A new method for training "discriminated" or"classical avoidance" was developed which makes possible the measurements of reaction time in the chimpanzee. Early experiments indicate that reaction time in chimpanzees may approach the speed of man. The Psychology Branch has been expanded to include behavioral studies with chimpanzees for which it is necessary to enlarge the chamber so it will be capable of operating 200 hours.

b. The design of animal performance equipment was incorporated into a mock-up of a training couch. McDonnell Aircraft Corporation is the Contractor for these couches and they delivered three in December which are now wired and in operation.

A zero gravity pellet feeder was developed for use with the training couches. The feeder will require specially developed pellets which the CIBA Pharmaceutical Products will produce.

Representatives of the McDonnell Aircraft Corporation visited the Psychology personnel to discuss development of animal performance equipment. NASA personnel were briefed on the rationale for using the performance tasks. A performance protocol report was prepared and distributed.

A purchase request was re-initiated for the development of a fully automatic perceptual monitoring task for primates. This item of equipment will afford both visual and auditory stimuli and features IBM programming and response recording. This purchase request was cancelled at WADC and both exhibit and bids were forwarded to the AFMDC buyer for re-initiation. The work statement was revised to include multiple class interval time analysis and to permit the contractor to rent an IBM machine in order to design an integrating unit for use with the monitoring task. Final signing of the contract is expected in the very near future. The Psychology Branch requested and received $40,000 with which it will fund service contract with a nearby university. The exhibit for this purchase request has been written and it is anticipated that work will begin on or about 1 February 1960. This contract, will extend capabilities in the area of small animal research and will be oriented to investigate the behavioral studies recommended at the Charlottesville Symposium.

Water reinforcement, while successfully used with rodents, has not been used extensively with primates. In turn, a completely automatic device for delivering liquid rewards has never been developed for use with primates. The first model of a liquid reinforcement device constructed at the base shops was completed and delivered. This device was designed for laboratory use only; adaptation for use during weightlessness is being investigated. The device was calibrated to determine the amount of water dispensed when activated by electrical pulses of different duration. Testing on animals has begun.

A newly developed restraining chair for chimpanzees was received from base shops and was tried out. This chair incorporates a method of restraining the animal by means of a neck yoke, thus eliminating the vest and harness arrangement formerly used. It appears to be a great improvement over the former chair.

c. Hq ARDC notified the Laboratory that instead of documenting the work of the Psychology Branch under Project 6892, a new project would have to be initiated. The 80-4 documentation for the project was worked on and the draft of the 613 and annexes were completed. In December, multilith copies of the 613 and annexes were completed and submitted to the Directorate. On 29 December, Major Rohles briefed the Center Staff on past accomplishments, present activities and prospectives under Project 6893.

d. Hq ARDC, through a contract with the University of Virginia, has hired Dr. Sylvan Kaplan as a consultant for the animal performance program. Dr. Kaplan visited here during October and will be here for 2 days every six weeks through June 1960. Dr. Kaplan is Chairman of the Psychology Department, Texas Technological College, Lubbock, Texas.

4. Trips

a. Captain Grunzke visited McDonnell Aircraft Corporation, St Louis, Missouri in December.

b. Dr. Belleville visited the University of Kentucky in November to discuss the contract concerned with the training of immature chimpanzees for possible use in biosatellite flights.

c. Major Mosely visited McDonnell Aircraft Corporation, St Louis, Missouri, NASA, Wallops Island and Hq ARDC.

d. Dr Cook, MSgt Pierce and SSgt Wiedeman visited the Zoological Gardens at Fresno, California for the purpose of giving a young ape an initial acceptance physical.

e. Dr. Fineg attended the Annual Animal Care Panel in Washington, D. C.

f. Dr. Edwards traveled to New Orleans, Louisiana on 10-15 November to complete his examination for board certification by the American Board of Pathology.

g. Lt Col Hessberg, Major Mosely, Captain Beeding, Captain Cook, Lt Miksch, TSgt Dittmer and SSgt Wiedeman attended the Military Surgeon's Meeting in Washington, D. C. 7-12 November 1959 and participated in a closed circuit television program.

5. Visitors

a. Drs Lange and Clark from the University of Kentucky visited the Physchology Branch this quarter to brief AMFL personnel on the training program being conducted at the Wenner-Gren Laboratory, University of Kentucky.

b. Representatives of the McDonnell Aircraft Corporation visited the Laboratory to discuss development of animal performance equipment to be used in chimpanzee flights.

6. Buildings

The week of 28 December 1959 the offices of the Aeromedical Field Laboratory moved from Building 1265 to Building 1264.

HISTORICAL DATA
AEROMEDICAL FIELD LABORATORY

DIRECTORATE OF ADVANCED TECHNOLOGY
AIR FORCE MISSILE DEVELOPMENT CENTER
Holloman Air Force Base, New Mexico

for Quarter III

1 July through 30 September 1959

Prepared by:

(Mrs.) LAURA CLAIR
Administrative Assistant

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FOREWARD

The following historical data have been compiled in accordance with AFM 210-1, AFR 210-3 and AFMDCR 210-1. It represents a factual account of the activities, accomplishments, problems and progress of this organization for the period indicated.

RUFUS R. HESSBERG, JR.
Lt Colonel, USAF,MC
Chief, Aeromedical Field Laboratory

TABLE OF CONTENTS

COMMAND DATA

1. Organization
   - a. Mission
   - b. Changes in Organization

2. Strength
   - a. Roster of Key Personnel
   - b. Chart of Personnel Strength
   - c. Personnel Changes

NARRATIVE

1. Progress of Projects and Tasks
   - a. Task 68921, "Attend Environments for Biological Specimens"
   - b. Task 68924, "Space Vehicle Test"
   - c. Task 68925, "Bio-Electronics"
   - d. Task 78503, "Tolerance to Impact Forces"
   - e. Task 78504, "Tolerances to Total Pressure Changes"
   - f. Task 78506, "Patterns of Deceleration in Space Flight"

2. Veterinary Services Support

3. Psychology Support

COMMAND DATA

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b. Changes in Organization: The Comparative Psychology Branch was established this report period.

2. Strength

a. Roster of Key Personnel:

Chief, Lt Col Rufus R. Hessberg, Jr., USAF, MC
Asst Chief, Maj Edward R. Regis, USAF
Chief, Bio-Astronautics Branch, Maj John D. Mosely, USAF, VC
Chief, Comparative Psychology Branch, Maj Frederick H. Rohles
Chief, Veterinary Services Branch, Capt James E. Cook, USAF, VC
Chief, Administration Branch, Capt Nat G. Bullard, Jr., USAF

b. Chart of Personnel Strength:

	OFFICERS	AIRMEN	CIVILIANS
Beginning of Period	16	18	23
Changes During Period	+4-2	+11-3	+4-8
End of Period	18	26	19

c. Personnel Changes:

Assignments:

Maj Frederick H. Rohles, Jr., Psychologist, 31 August 1959
Capt Marvin E. Grunzke, Psychologist, 25 August 1959
Capt Robert H. Edwards, Pathologist, 24 September 1959
1st Lt Norman E. Stingely, R&D Staff Officer, 14 June 1959
S/Sgt Ronald F. Shuckerow, Admin Clerk, 9 July 1959

S/Sgt Paul K. Kilman, Supply Spec, 20 September 1959
A/2C Loren L. Bartrand, Scientific Aide, 18 August 1959
A/3C Virgil H. Schwandt, Physical Science Aide, 3 August 1959
A/3C Robert D. Bush, Scientific Aide, 17 August 1959
A/3C David L. Morgan, Scientific Aide, 20 August 1959
A/3C Marion L. Rathbun, Scientific Aide, 31 August 1959
A/3C Gilberto Diaz, Jr., Med Svs Spec, 4 September 1959
A/3C Samuel F. Cole, Scientific Aide, 21 September 1959
A/3C Donald L. Beacham, Vet Spec, 23 September 1959

Hired:

Shirly Elmore, Secretary, 21 July 1959
Richard E. Belleville, Psychologist, 26 July 1959
Samuel R. Hill, Scientific Aide, 8 July 1959
Cubia L. Clayton, Scientific Aide, 5 August 1959

Reenlistments:

M/Sgt Lee V. Pierce, Aeromed Tech, 18 September 1959

Transfers:

Capt Druey P. Parks, Chief, Admin Br, 6 July 1959
Capt Grover J. D. Schock, Asst Chief, BioAstronautics Br, 9 October 1959
S/Sgt Robert A. Knox, Aeromed Spec, 10 October 1959

Resignations:

Sidney W. Cook, Scientific Aide, 28 August 1959
Stephen S. Easter, Scientific Aide, 28 August 1959
Thomas L. McConnell, Scientific Aide, 7 August 1959
Nancy K. Wiant, Secretary, 21 August 1959
Cubia L. Clayton, Scientific Aide, 15 September 1959
LeMerle Black, Secretary, 31 July 1959
Samuel R. Hill, Scientific Aide, 28 August 1959
Richard A. Chen, Scientific Aide, 4 September 1959

Discharges:

M/Sgt Lee V. Pierce, Aeromed Tech, 17 September 1959
A/2C Alfredo Martinez, Aeromed Spec, 8 August 1959

1. Progress of Projects and Tasks

a. Task 68921. "Attend Environments for Biological Specimens"

Space Biology

Isolation and restraint conditioning studies of small primates have continued this report period. Placing the subjects in a near-supine position has pin pointed certain problem areas, the major one is that the excreta pan is practically unusuable. Psychomotor training has shown considerable progress of three subjects. A fourth subject will not eat during restraint, and all reward type attempts to condition him to the psychomotor device have been unsuccessful. This subject was flown four hours for the first time. His reaction to flight was of interest from both a clinical and psychological viewpoint: The subject's pulse was over 100 beats per minute for most of the flight, although respiration ranged from 32 to 40 per minute. His palm's were covered with sweat, also the bold area of the face, though temperatures were as low as 65° F at one time. He unsuccessfully fought restraint but ate two bananas and two oranges which is a marked contrast to the usual noneating habits of subjects during restraint in flight.

The first thermal-humidity test was conducted using a biological subject. Experience in procedures and recording techniques was obtained from this test.

b. Task 68924. "Space Vehicle Test"

Preliminary preparation of a Management Report reflecting SARV MARK II chamber tests has been completed. Recording techniques for the thermal test and instrumentation has been a major objective for this task.

c. Task 68925, "Bio-Electronics"

Balloon flights were launched from Minnesota during this report period. Captain dePaul Corkhill was the Task Officer for these flights. Reduction of the tapes made during the balloon flights has begun. The nuclear emulsions exposed on the balloon flights were returned to the contractor, New Mexico State University. Documentation for a new task, which would include the cosmic radiation aspects of this task, have been drafted.

d. Task 78503 "Tolerance to Impact Forces"

The Chicago Midway Laboratories sent two technicians to complete repair, modification and installation of the Air Gun Propulsion device. As soon as the system is ready to run an engineer will arrive to complete the acceptance tests. Mr Feder is designing a "snap-on" seat for Daisy Sled #1. Two dummy runs were made 6 July on Daisy Track to establish a sled brake pattern of 10 G to 200 Gs. Three human runs were made on 8 and 9 July. On the basis of past experience this sled brake pattern should have given the backward facing subject G of 15 with a rate of 2500 G/sec. The six subjects received average values of 13 G at only 1000 G/sec. The low rate of onset is being studied.

Nine dummy runs were made between 13-17 July in an effort to establish low G high rate of onset brake patterns. These efforts were unsuccessful in that the highest rate of onset obtained was 2000 G/per sec in the 10-20 peak G range. Since previous tests indicate that rates of onset of approximately 8000 G per second would be required to affect the subject at the 20 G level, it appears that with the present brake definitive rate of onset studies will be impossible.

e. Task 78504. "Tolerances to Total Pressure Changes"

The 12th Monthly Progress Report to American Machine and Foundry Company has been completed. The contractor asked for an additional rabbit head cast for this task. Five beagles have been obtained for use in this task.

f. Task 78506. "Patterns of Deceleration in Space Flight"

Records of ten water tank runs of the Daisy Track were partially analyzed. During one run the "plexiglass" side walls of the tank failed, giving further evidence as to the pressure distribution. The telephonic system for the underwater breathing device have been assembled. A makeshift system will be built based on the actual capsule breathing device so that the entire system can be used in the water indoctrination program. A model of a man (approximately 12 inches long and made of foam rubber) was made to be used as a subject for the under water deceleration studies on the Daisy Track. The model has small 5G and 25G accelerometers inserted in the chest in the X and Z position in preparation for the second series of tests. Equipment is being assembled and modified so a small pilot model of the large capsule animal breathing system can be built. The subject for this model will be a rat to be sustained under water for the third series of tests on the Daisy Track.

2. Veterinary Services Support

a. At the beginning of the quarter, 432 zoological specimens of six different species were in the Vivarium.

b. Used for classified studies were four C-57 black rodents. Small primates are issued daily for conditioning studies.

c. Seventeen young primates were bought from the Miami Rare Bird Farm, Miami, Florida.

d. Clinical laboratory support included 75 EKG tracings, 295 hematology studies, 75 urinalysis, 268 stool examinations and 41 Xrays, 604 microscopic slides were made for histopathology studies.

3. Psychology Support

a. During this report period a Comparative Psychology Branch was added to the laboratory. The mission consists of measuring animal behaviour as affected by exposure to space environments. A primary task will be training chimpanzees to be used in the Mercury program. This branch has two sections; Training and Research Section and Apparatus Development Section. The Research and Training Section establishes experimental protocol for measuring the effects of space environments on learned behavior; and the Apparatus Development Section is responsible for designing apparatus for measuring animal performance.

b. There are three psychologists and four airmen who have college degrees with psychology majors assigned to this branch. Work during this reporting period has been concerned primarily with the procurement of equipment for the measurement of behavior of chimpanzees.

HISTORICAL DATE
AEROMEDICAL FIELD LABORATORY

DIRECTORATE OF ADVANCED TECHNOLOGY
AIR FORCE MISSILE DEVELOPMENT CENTER
Holloman Air Force Base, New Mexico

For Quarter II

1 April through 30 June 1959

Chr
Data

Prepared by:

(MRS.) LAURA CLAIR
Administrative Assistant

HDNH 1-1-2-24-5
Initialed 7c
Bibliog. ✓
Chronolog ✓
Data Cards ✓

FOREWARD

The following historical data have been compiled by this organization in accordance with the provisions of Office Instruction 210-6. It represents a narrative account of the activities, accomplishments, problems, and progress of this organization for the period indicated.

RUFUS R. HESSBERG, JR.
Lt Colonel, USAF(MC)
Chief, Aeromedical Field Laboratory

TABLE OF CONTENTS

COMMAND DATA

1. Organization
    a. Mission
    b. Changes in Organization

2. Strength
    a. Roster of Key Personnel
    b. Chart of Personnel Strength
    c. Personnel Changes

NARRATIVE

1. Progress of Projects and Tasks
    a. Project 6892, "Bio-Medical Tests"
    b. Task 68920, "Biological Specimen Support"
    c. Task 68921, "Altered Environments for Biological Specimens"
    d. Task 68923, "Operations Techniques"
    e. Task 68924, "Space Vehicle Test"
    f. Task 68925, "Bio-Electronics"
    g. Task 78503, "Tolerance to Impact Forces"
    h. Task 78504, "Tolerance to Total Pressure Changes"

2. Veterinary Services

3. Meetings, Conferences, Symposiums

COMMAND DATA

1. Organization

a. Mission: Develops improved techniques for human factors track testing procedures and instrumentation, determines human physiological tolerances to abrupt decelerations, develops methods and procedures for testing biosatellite capsules and components, maintains adequately conditioned series of animals for all track, chamber, and biosatellite test operations, provides pre- and post-test clinical evaluation of test animals, coordinates and directs all biosatellite test programs.

b. Changes in organization: The Satellite Operations Branch was re-named Bio-Astronautics Branch and the Laboratory Branch name was changed to Veterinary Services Branch this report period.

2. Strength

a. Roster of Key Personnel:

Chief, Lt Col Rufus R. Hessberg, Jr., USAF(MC)
Asst Chief, Maj Edward R. Regis, USAF
Chief, Bio-Astronautics Branch, Maj John D. Mosely, USAF(VC)
Chief, Administration Branch, Capt Druey P. Parks, USAF
Chief, Veterinary Services Branch, Capt James E. Cook, USAF(VC)

b. Chart of Personnel Strength:

	OFFICERS	AIRMEN	CIVILIANS
Beginning of Period	18	18	20
Changes During Period	-2	+1-1	+7-4
End of Period	16	18	23

c. Personnel Changes:

Assignments:

A/3C Hayden L. Clark, Instrumentation Specialist, 15 May 59

Hired:

Mrs. Ethel M. Driskill, Secretary, 31 May 59
Mr. Bobby J. Teal, Animal Caretaker, 31 May 59
Mr. Sidney W. Cook, Physical Science Aid, 1 Jun 59
Mr. Stephen S. Easter, Physical Science Aid, 8 Jun 59
Miss Nancy K. Wiant, Secretary, 9 Jun 59
Mr. Thomas L. McConnell, Physical Science Aid, 16 Jun 59
Mr. Richard A. Cheu, Med Biology Technician (Gen), 18 Jun 59

Transfers:

1/Lt Clifton L. McClure, R & D Officer Special, 15 May 59
Mrs. Eunice M. Leck, Secretary, 3 May 59
S/Sgt John (NMI) Suitryk, Aeromed Tech, 14 Jun 59
Mr. Frank Frazier, Illustrator, 1 Jun 59

Resignations:

Mr. Ray Skaggs, Animal Caretaker, 3 Apr 59
Mrs. Mary Nelson, Secretary, 29 May 59

Discharges:

1/Lt Daniel E. Enfield, R & D Officer Special, 15 Apr 59

1. Progress of Projects and Tasks

a. Project 6892, "Bio-Medical Tests"

This project is written to support TR 243-58 and TH 224-58 dated 1 August 1958. Official ARDC approval of this project was 4 Feb 59. During this report period a management report was submitted naming Maj John D. Mosely, Project Officer replacing Lt Col Rufus R. Hessberg, Jr.

b. Task 68920, "Biological Specimen Support"

Seventeen small primates are undergoing physiological base-line studies. These studies include establishing heart rate, blood pressure, and respiration rate.

c. Task 68921, "Altered Environments for Biological Specimens"

Biological specimens were exposed to the shock stimulus. The maximum current applied was 300 volts at 20 cycles per second. The only response was a rhythmic muscular contraction. Electrodes were placed next to the skin on the lateral mid-axillary line at the sixth rib, palms of the hands, and under the armpits. The surface of the ears were tested and stimulus was not sufficient to provoke attention in the subjects. A daily seven hour semi-dark isolation restraint period program has been conducted on small primates. At times, subjects were placed in nearly supine positions in the restraint chairs, but no changes were noted in subject's response. Aerial flights for these young chimpanzees continues. A flight was made with the psychomotor device. The female subjects were not interested in operating the board. Responses to the psychomotor devise on the ground have been excellent. The subjects flick the switch on request; however, no attempt has been made to determine if the subject distinguishes if the light is "on" or "off" before flicking the switch. An attempt will be made to determine if the subjects are responding to a visual cue or merely flicking the switch in hope of a reward.

d. Task 68923, "Operations Techniques"

Progress on this task is classified.

e. Task 68924, "Space Vehicle Test"

Chamber tests of Mark II were made. This included all bio-electronic support as well as life cell support. USE 133, MARK II SARV was run on the Daisy Track.

A test was made to prove or disprove a theory for determining leak rate of a life cell and the resulting oxygen pressure as a consequence of a leak. The test was inconclusive for two reasons. First, the mercury manometer was read incorrectly; second, the pressure readings from the life cell sensor indicated that the cell was essentially leak free which would not produce any significant changes in oxygen partial pressure as a result of dilution with nitrogen.

f. Task 68925, "Bio-Electronics"

Balloon flights are scheduled for July to be launched from Minnesota. Most of this report period has been used to firm up details.

g. Task 78503, "Tolerance to Impact Forces"

Acceptance tests on the new propulsion device, air gun accelerator continue. Because of an inadvertent non-filling of the water brake, a sled was damaged beyond repair. Final arrangements for procuring a new Daisy Track Sled to replace the damaged one has been completed.

Lack of reproducibility of sled patterns forces conclusion that the "Bopper" should be used for only low G (109) runs.

The problem of defining the "rate of onset" in abrupt deceleration experiments still confronts this task. It seems that the problem is not one of pure definition but of defining the relationship of peak G and time to reach peak G with both a mathematical and biological meaning without recourse to inspection of the record.

Mr. Feder has made an analysis of the problem based on impulse phenomena. It is apparent that the experimental situation is over burdened with too many variables. First, we should attempt to remove as many variables as possible. Some have been removed and more to follow, but the greatest variable still present is the brake pattern with all its vibrations that are not reproducible. We need a standard reproducible system with which we can control all variables but one--something called "rate of onset." A new stopping system for the Daisy Track coupled with the soon to be completed air gun accelerator will aid greatly. Another device which should be procured is the Hy-G Tester. For the present we will evaluate a complete series of runs with respect to Mr. Feder's analysis.

h. Task 78504, "Tolerance to Total Pressure Changes"

Lt Ward, Task Scientist, and Mr. John Nichols, AF Purchasing Agent, visited American Machine and Foundry Company, Chicago, Illinois, to resolve the problem of overrun in funds by the Contractor. The result of the visit was an agreement by the contractor to complete all fabrications on the pressure chamber, including masks and electrical connections. Date of completion is (estimated) 31 Jul 59.

2. Veterinary Services

This branch provides and maintains an experimental vivarium, provides biological specimen baseline data and pathology support in general.

a. At the beginning of the quarter 551 biological specimens of seven different species were on hand and at the end of the quarter 432 specimens of six different species were on hand.

b. Used for classified studies during this period were 62 C-57 black rodents. Four small primates are issued daily for conditioning studies. Seven rhesus monkeys from the School of Aviation Medicine have been issued periodically for classified studies.

c. Clinical laboratory support included 28 EKG tracings, 806 hematology studies, 63 urinalysis, 133 stool examinations and 35 X-rays, for histopathology examinations, 244 microscopic slides were made. In support of the lab mission, 40 biological specimens were autopsied.

d. Experimental surgery consisted of 20 special implants. Seventeen small primates are undergoing physiological baseline studies.

3. Meetings, Conferences, Symposiums

Date
Area

Capt James E. Cook went to Vandenberg AFB, California and on to Hawaii in support of Project 6892. Capt Druey P. Parks went to Hawaii in support of the same classified mission. Mr. Fred Henry of Norair Corporation visited the lab for two days to discuss the water tank procurement for Task 78506. Dr. Welch from School of Aviation Medicine brought their bio-pack to us in May.

HISTORICAL DATA
AEROMEDICAL FIELD LABORATORY

DIRECTORATE OF ADVANCED TECHNOLOGY
AIR FORCE MISSILE DEVELOPMENT CENTER
Holloman Air Force Base, New Mexico

For Quarter I

1 January through 31 March 1959

Prepared by:

(Mrs.) LAURA CLAIR
Administrative Assistant

HDNH 1-1-2-24-5
Initialed 7 C
Biblio. ✓
Chronolog 0
Data Cards 0

FOREWORD

The following historical data have been compiled by this organization in accordance with the provisions of Office Instruction 210 - 6. It represents a narrative account of the activities, accomplishments, problems, and progress of this organization for the period indicated.

Edward [illegible] for.
RUFUS R. HESSBERG, JR
Lt Colonel, USAF(MC)
Chief, Aeromedical Field Laboratory

TABLE OF CONTENTS

COMMAND DATA

1. Organization
   a. Mission
   b. Changes in Organization

2. Strength
   a. Roster of Key Personnel
   b. Chart of Personnel Strength
   c. Personnel Changes

NARRATIVE

1. Progress of Projects and Tasks
   a. Project 6892, "Bio-Medical Tests"
   b. Task 68920, "Biological Specimen Support"
   c. Task 68921, "Altered Environments for Biological Specimens"
   d. Task 68923, "Operations Techniques"
   e. Task 68924, "Space Vehicle Test"
   f. Task 78503, "Tolerance to Impact Forces"
   g. Task 78504, "Tolerance to Total Pressure Changes"
   h. Task 78505, "Tolerance to Ram Pressure"
   i. Task 78506, "Patterns of Deceleration in Space Flight"
   j. Task 78507, "Car Crash"

2. Veterinary Services

3. Equipment

4. Meetings, Conferences, Symposuims

5. Management Improvement

6. Special Features

COMMAND DATA

1. Organization

a. Mission: Develops improved techniques for human factors track testing procedures and instrumentation, determines human physiological tolerances to abrupt decelerations, develops methods and procedures for testing biosatellite capsules and components, maintains adequately conditioned series of animals for all track, chamber, and biosatellite test operations, provides pre- and post-test clinical evaluation of test animals, coordinates and directs all biosatellite test programs.

b. Changes in Organization: None

2. Strength

a. Roster of Key Personnel:

Chief, Lt Col Rufus R. Hessberg, Jr., USAF(MC)
Asst Chief, Maj Edward R. Regis, USAF
Chief, Administration Branch, Capt Druey P. Parks, USAF
Chief, Laboratory Branch, Capt James K. Cook, USAF(VC)
Chief, Satellite Operations Branch, Capt John D. Mosely, USAF(VC)

b. Chart of Personnel Strength:

	OFFICERS	AIRMEN	CIVILIANS
Beginning of Period	18	14	20
Changes During Period	+3 -3	+7 -3	+3 -3
End of Period	18	18	20

c. Personnel Changes:

Assignments:

A/3C Arnold D. Lovan, Scientific Aide, 4 February 1959
A/3C Arthur C. Kappler, Scientific Aide, 6 February 1959
A/2C William E. DuBose, Courier, 4 March 1959
A/3C Charles H. S. Watkins, Scientific Aide, 26 February 1959
A/3C Zirkle V. Cooper, Scientific Aide, 27 March 1959
SSgt Nathaniel S. Cornwell, Instrument Mechanic, 2 January 1959
A/1C Carlos J. Smith, Med Lab Specialist, March 1959
Capt Jerry Fineg, Veterinary Officer General, January 1959
Capt Nathaniel G. Bullard, R & D Staff Assistant, 26 February 1959
1/Lt Phillip H. Darling, Aviation Physiologist, 17 February 1959

Hired:

Mrs. Mary E. Nelson, Clerk-Stenographer, 8 February 1959
Mrs. J. Le Merle Black, Secretary, 3 February 1959
Mrs. Eunice Leck, Secretary, 8 February 1959

Transfers:

Lt Colonel David G. Simons, Medical Officer, 15 January 1959
S/Sgt Ernest F. Owens, Scientific Aide, March 1959
A/3C Arthur C. Kappler, Scientific Aide, 26 March 1959
SSgt Jack E. Boreman, Aeromed Lab Specialist, 15 March 1959

Resignations:

Miss Nancy K. Wiant, Secretary, 16 January 1959
Mrs. Faye D. Larsen, Secretary, 6 February 1959
Mrs. Kathyrn A. Yager, Secretary, 6 February 1959

Discharges:

Capt John Recht, Veterinary Officer General, 28 February 1959
1/Lt Daniel L. Enfield, R & D Officer, Specialist, 27 March 1959

1. Progress of Projects and Tasks

a. Project 6892, "Bio-Medical Tests"

This project is written to support TR 243 - 58 and TR 224 - 58 dated 1 August 1958. Official ARDC approval of this project was 4 Feb 59.

b. Task 68920, "Biological Specimen Support"

Dr. Cook and his staff have initiated a study to establish physiological base lines on immature chimpanzees. These studies include establishing heart rate, blood pressure, and respiration rate. Large primates were sent to the School of Aviation Medicine for basal metabolic rate tests.

c. Task 68921, "Altered Enviornments for Biological Specimens"

Immature chimpanzees are still being taught to sit restrained in a seat for long periods of time. Two male and two female chimpanzees will now sit for 8 hours at a time. The animals habits and reactions during this training are noted. In addition to the seat training, aerial flights have been started for these young chimpanzees. Detailed notes are kept on the animal's reactions to aircraft noise, vibration, acceleration and not infrequently, rough weather which initiates the young chimps to air-sickness. Photographs of the aerial flights have been made. Another training device for the young chimpanzees is a psychomotor board which requires the animal to turn out a light within a given time or be given a small electric shock as punishment for being late. A preliminary report is being written on these training aides by Lt Ward.

d. Task 68923, "Operations Techniques"

Classified procedures and check lists have been completed for Project Snowball I. This is an in-house title as the project is classified.

e. Task 68924, "Space Vehicle Test"

Activities for this task are classified and are primarily confined to Snowball I and II test programs.

f. Task 78503, "Tolerance to Impact Forces"

"Bopper" runs have been made for evaluation of the EDIN EKG system. The system was accepted and the contract terminated. Installation of the concrete pad at the east end of the "Daisy Track" has been completed. Chicago Midway Laboratories will arrive in April to install the air-gun accelerator.

A contract has been let with Land-Air for mechanical support of the "Daisy" track. As an initial project, Land-Air sand-blasted the track and painted it blue.

Mr. Feder and Lt Zaborowski have written two technical notes outlining theoretical and practical engineering parameters for a new water brake for the "Daisy Track". This new type water brake would permit research on the effects of high *g* forces with greater rates of onset.

g. Task 78504, "Tolerance to Total Pressure Changes"

Lt W. E. Ward replaced Lt A. V. Zaborowski as Task Scientist.

The contract with American Machine & Foundry Company progresses slowly. Minor technical problems were resolved by conference calls. The company asked for and received an additional extension of the contract until 12 May 1959. The cost overrun of $9500.00 submitted late in March was viewed with some prejudice. A future visit to the company by Lt Ward, Task Scientist and Mr. Nichols, Center Procurement, is hoped to solve the problems concerning this overrun.

h. Task 78505, "Tolerance to Ram Pressure"

Vibration data obtained by telemetry on runs 6 August 1958 and 29 October 1958, have not been reduced by Telecomputing to date. Lt Zaborowski has contacted Analysis and Computation Division for assistance in reducing these data.

Telecomputing is looking into the possibility of reducing data from on-board Northam Model MR-1 recorders in the future.

i. Task 78506, "Patterns of Deceleration in Space Flight"

"Bopper" runs were made using the small underwater deceleration tank with frogs as subjects. EKG recordings were made on the frogs prior to the run. Autopsies of the frogs after they had sustained eight to nine g's impact indicated no damage. The films taken during the "Bopper" runs are being analyzed for movement of the frogs during deceleration.

j. Task 78507, "Car Crash"

This task is being terminated. The 80-4 documentation has been prepared in outline form. A final technical report on the life of this task has been completed in draft form by the Task Scientist, Lt Enfield.

2. Veterinary Services

This Branch provides and maintains an experimental vivarium, provides biological specimen base-line data, and general pathology support for the Aeromedical Field Laboratory projects and tasks.

a. At the beginning of the quarter the Veterinary Services Branch had on hand 335 biological specimens of six different species and at the end of the quarter, 551 biological specimens of seven different species.

b. A colony of 39th generation C-57 black marked mice has been established. The School of Aviation Medicine Vivarium contributed four colonies of C-57 black mice to our vivarium. The University of California and the School of Aviation Medicine gave us fifteen C-17 black mice to use in establishing five sublines of marked C-57 black mice colonies.

c. Thirty-four C-57 black mice were issued for use in classified studies, four small primates are used daily for conditioning studies. Three frogs were used for underwater studies on the "Bopper". One frog was a subject on the "Daisy" sled.

d. Clinical laboratory support included 32 EKG tracings, 25 hematology studies, 22 urinalyses, 56 stool examinations, and 12 X-rays. For histopathology examinations, 353 microscopic slides were provided.

e. Experimental surgery consisted of four special surgical implants on biological specimens. Seven large primates were given physiological base-line studies.

3. Equipment

Pressure transducers and adapters have arrived and more are on order.

4. Meetings, Conferences, Symposiums

Lt Col Hessberg went to Wright-Patterson AFB, Ohio on 2 February to attend the Air Force Medical Research Council Meeting and to give a presentation as Chief of the Aeromedical Field Laboratory to help clarify the laboratory's relationship with NASA and man-in-space program.

Dr. John D. Mosely and Dr. Hessberg went to Headquarters, USAF, on 18 January to present Aeromedical Field Laboratory's program to the National Aeronautical and Space Agency and to the Advanced Research Project Agency.

Dr. Harald J. A. von Beckh addressed the American Rocket Society at Cincinnati, Ohio on 4 March.

A meeting was held in the conference room of Building 1265 on 17 January to discuss future programs involving human runs. A decision was made to request permission from ARDC to do human runs in support of Project 7850. Persons attending this meeting were: Col J. P. Stapp, WADC; Dr. Lombard and Mr. Nelson of Protection Incorporated.

Representing the Aeromedical Field Laboratory was Lt Col Hessberg, Major Regis, Captain Mosely, and Captain Beeding.

5. Management Improvement

A thorough cleaning of the 1200 area is completed. Weeds were cut and burned and the grounds scraped and leveled. The grease rack behind Building 1201 was moved to the Auto Hobby Shop.

6. Special Features

Lt Col D. Bates, a reserve officer, spent two weeks in the Laboratory in January. He is associated with the U. S. Fish and Wild Life Service in Oregon. He was assigned to Task 78505, "Tolerance to Ram Pressure" for his tour. He contributed greatly in procurring amphibians to use in this task. He obtained literature and helped build a terra-aquarium for our frogs and fish.

HISTORICAL DATA
AEROMEDICAL FIELD LABORATORY

DIRECTORATE OF ADVANCED TECHNOLOGY
AIR FORCE MISSILE DEVELOPMENT CENTER
Holloman Air Force Base, New Mexico

For Quarter IV

1 September through 31 December 1958

Prepared by:

(MRS.) LAURA CLAIR
Administrative Assistant

HDNH 1-2-7-1
Initialed
Bibliog. ✓
Chronolog 2
Data Cards 0

FOREWORD

The following historical data have been compiled by this organization in accordance with the provisions of Office Instruction 210-6. It represents a narrative account of the activities, accomplishments, problems, and progress of this organization for the period indicated.

RUFUS R. HESSBERG, JR.
Lt Colonel, USAF(MC)
Chief, Aeromedical Field Laboratory

TABLE OF CONTENTS

COMMAND DATA

1. Organization
    - a. Mission
    - b. Changes in Organization
2. Strength
    - a. Roster of Key Personnel
    - b. Chart of Personnel Strength
    - c. Personnel Changes

NARRATIVE

1. Progress of Projects and Tasks
    - a. Project 6892, Bio-Astronautics
    - b. Project 7851, Human Factors of Space Flight
    - c. Task 78503, Tolerance to Impact Forces (Proj 7850)
    - d. Task 78504, Tolerancd to Total Pressure Changes (Proj 7850)
    - e. Task 78505, Human Tolerance to Windblast
    - f. Task 78506, Patterns of Deceleration in Space Flight
    - g. Task 78507, Car Crash
2. Laboratory Branch
3. Buildings
4. Equipment
5. Management Improvement
6. Meetings, Conferences, Symposiums
7. Special Features

COMMAND DATA

1. Organization

a. **Mission:** Develops improved techniques for human factors track testing procedures and instrumentation, determines human physiological tolerances to abrupt accelerations, develops methods and procedures for testing bio-satellite capsules and componenets, maintains adequately conditioned series of animals for all track, chamber, and biosatellite test operations, provides pre- and post-test clinical evaluation of test animals, coordinates and directs all biosatellite test programs.

b. **Changes in Organization:** On 1 September 1958, the Directorates of R&D and Ballistic Missile Test were terminated and the new Directorate of Advanced Technology organised. The Aeromedical Field Laboratory was made a Division under the new Directorate with four Branches under the Laboratory; Admigistration Branch, Biosatellite Operations Branch, Biodyhamics Branch, and Veterinary Services Branch.

2. Strength

a. **Roster of Key Personnel:**

Chief, Lt Col Rufus R. Hessberg, Jr., USAF(MC)
Asst Chief, Maj Edward R. Regis, USAF
Chief, Administration Branch, Capt Drusy P. Parks, USAF
Chief, Laboratory Branch, Capt James E. Cook, USAF(VC)
Chief, Satellite Operations Branch, Capt John D. Mosely, USAF(VC)

b. **Chart of Personnel Strength:**

	OFFICERS	AIRMEN	CIVILIANS
Beginning of Period	16	18	22
Changes During Period	+3	-5 +5	-4 +2
End of Period	19	18	22

c. Personnel Changes:

Assignments:

Maj Edward R. Regis, Asst Chief, 15 September 1958
Capt Robert Hook, Physicist, 22 September 1958
1st Lt Eldon D. Miksch, Veterinary Officer, 27 November 1958
A/3C William F. Hack, Scientific Aide, 3 November 1958
A/3C Robert J. Lockhart, Scientific Aide, 15 November 1958
A/3C James F. Mooney, Scientific Aide, 10 November 1958
SSgt Ernest S. Owens, Scientific Aide, 5 December 1958

Hired:

Miss Faye Stowell, clerk-typist, 15 September 1958
Mrs. Melva R. Shaw, clerk-typist, 16 November 1958

Resignations:

Miss Trixie Austin, Summer Aide, 15 September 1958
Mr. Jack C. Bunn, Summer Aide, 21 September 1958
Mr. Cubia L. Clayton, Summer Aide 21 September 1958
Mrs. Roberta Newman, clerk-typist,21 November 1958

Transfers:

SSgt William A. Morris, Vehicle Operator, 11 September 1958
A/3C Gonzlee Culbreath, Medical Helper, 13 December 1958

Discharges:

SSgt John Suitryk, Aeromed Technician, 2 September 1958
A/2C Bobby Teal, Veterinary Specialist, 20 November 1958

Reenlistments:

SSgt John Suitryk, AeroMed Technician, 3 September 1958

Conversions:

Miss Nancy Wiant, clerk-typist, 22 September 1958

1. Progress of Projects and Tasks

a. Project 6892, "Bio-Astronautics"

This is a new project written to support TR 243-58 and TR-244-58, dated 1 August 58. The objective of the project is to insure the biological adequacy of all systems intended for space flight, including orbital flight through development of required testing methods, operational techniques, bio-electronic measuring techniques, and extraction of the maximum amount of postmission information. This project has not been officially approved as yet, although 80-4 documentation has been accomplished.

There are five tasks under Project 6892:

1. Task 68920, "Biological Speciment Support"
2. Task 68921, "Environment for Biological Specimens"
3. Task 68922, "Postmission Analyses of Biological Specimens"
4. Task 68923, "Operations Techniques"
5. Task 68924, "Space Vehicle Test"

Efforts under these tasks are contractural with additional in-house work. The larger share of the work done in this project during the early part of this reporting period was to establish test directives and experimental protocols for work at the WADC Centrifuge Facility and at the AFMDC high altitude chamber and captive missile tracks (Daisy and long track) in support of the classified Snowball I project. In connection with this project, a series of experiments and tests was conducted at the WADC Centrifuge Facility during the month of December. The data is classified and has not been reduced. A complete report will be submitted at the completion of the Snowball I Testing Program. Arrangements for the high-altitude chamber and captive missile track tests for Snowball I were made, and tests tentatively scheduled for the early part of January 1959.

Unclassified in-house efforts included a program for conditioning immature chimpanzees to sit restrained for long periods of time. This program is progressing nicely, with subjects trained to sit for as long as eight hours at present. This training program continues at close of reporting period.

b. Project 7851, "Human Factors of Space Flight"

During the first part of September, Captain Harry Collins and Lt Clifton McClure, candidates for pilot on the MANHIGH III balloon flight, went through the extensive selection and training procedure required. After going through a battery of re-tests, Captain Collins was disqualified for medical reasons.

Lt McClure, the sixth potential pilot, proceeded with his training in the hope that the flight could be made before winter weather set in. His final qualification was delayed by the time lost waiting for favorable weather for flying the small "Sky-Car" balloons. This qualification was finally completed in late September and all necessary personnel proceeded to Crosby, Minnesota, for the expected launch. However, by this time the winds aloft had made their winter shift and would have given an undesirable drift into Canada. Consequently, operations were moved to Holloman Air Force Base, where the launch was made from one of the runways on the morning of 8 October 1958. Lt McClure reached an altitude of 99,000 feet and remained there for approximately four hours. A high air temperature inside the capsule forced a premature termination of the flight. The pilot returned safely, though exhausted.

The remainder of this period has been used in compiling and analyzing data from this flight and in writing the MANHIGH III Final Report.

This project has been terminated and the following contracts transferred to the School of Aviation Medicine, Randolph Air Force Base, Texas:

AF 29(600) 1681	University of Texas	$ 15854.00
AF 29(600) 1477	Florida State University	14600.00
AF 29(600) 1476	Brown University	22508.00
AF 29(600) 1723	Yale University	29000.00
AF 29(600) 1729	Northwestern University	10000.00
AF 29(600) 1735	Baylor Univ Coll of Med	15950.00
		$ 107912.00

c. Task 78503, "Tolerance to Impact Forces"

Daisy Sled tests using animal and human subjects with seat position being varied to study impact forces acting at varying angles to the spinal cord, continue. Physiological instrumentation used in these tests included an EKG machine built by Edin Manufacturing Company under contract AF 29(600) 1683. Evaluation tests indicate their EKG capable of functioning under accelerations of 50 to 60g. Contract AF 29(600) 1492 with Cnicago Midway Laboratories for an air-gun accelerator is progressing. A cost overrun of $17,000, plus a delay in completion of the concrete pad, necessitated an extension of the contract to the end of May 59. Work on Contract AF 29(600) 1676, a head-restraint system is continuing satisfactorily. Contract AF 29(600) 1683 for a physiological pressure transducer is progressing nicely. Preliminary difficulties for a contract with Land-Air, Inc., for mechanical support of the Daisy Track Facilities are being worked out satisfactorily.

d. Task 78504; "Tolerance to Total Pressure Change"

During the reporting period Lt William Ward replaced Lt Albert Zaborowski as Task Scientist. This task is still in its infancy. A complete background bibliography is being compiled. Contract for a hydraulic pressure chamber to study pressure effects on two biological specimens, rabbits and dogs, continues. The contractor, American Machine and Foundry Co, asked for and received an extension of the contract from November 1958 to February 1959. This extension is at no additional expense to the government.

e. Task 78505, "Human Tolerance to Windblast"

In the early part of this reporting period, work was directed to procuring hardware. Protective garments were procured under Contract AF 29(600) 1663 with Protection Inc. A dummy was exposed to a windblast run at 1604 feet per second on 29 October with no damage sustained by the dummy or the protection garment. Telemetry data was obtained for the entire run. This is the first Aeromedical Field Laboratory long-track run from which telemetry data was obtained for the entire run. The chanel-by-channel vibration data obtained on this run was forwarded to Data Reduction, but no reduced graphs have been obtained to date.

f. Task 78506, "Patterns of Deceleration in Space Flight"

Efforts in this task were largely confined to design and construction of various sizes of water tanks for use in studying deceleration effects on submerged animals. This work is preparatory for human experiments. The Contract AF 29(600) 1815 for human capsules to be used in such experimentation continues. Preliminary reports indicate the contractor is progressing satisfactorily. Contract AF 29(600) 1815 was amended during this period to provide modification of the sled and necessary pusher vehicles. In-house efforts were directed toward solving the problems of data telemetry during an experiment and the problem of voice communication during human experimentation. Water tanks for preliminary tests on animate and inanimate subjects were designed and fabrication begun.

g. Task 78507, "Car Crash"

Work in this task has been terminated. All efforts during this period were directed toward obtaining data for completion of the Car Crash Final Report with emphasis placed on evaluation of seat belt restraint. The final report will include results obtained from work done under contract at the University of Minnesota and UCLA. Preliminary groundwork was laid for completing the 80-4 documentation required to terminate this task.

2. Laboratory Branch

This Branch provides and maintains an experimental vivarium, renders pathology, and biological specimen-conditioning services.

a. Animals on hand at the beginning of the reporting period were 253 biological specimens of 8 different species, and at the end of the quarter, 335 biological specimens of 6 different species. Because they were no longer of research or salvage value, 96 biological specimens were humanly destroyed. The outstanding biological specimen purchase was 200 rodents.

b. Clinical laboratory support included 72 EKG tracings, 32 hematology studies, 71 urinalyses, 36 stool examinations, and 16 X-rays. Seventy-six microscopic slides were provided for histopathology examination. Fifty-five autopsies were performed on biological specimens.

c. Experimental surgery consisted of 60 special surgical implants on biological specimens. A mastoidectomy was made on one biological specimen and a fractured radius was set on one biological specimen. Temperature and humidity-tolerance studies of biological specimens, conducted by Capt Recht are continuing. The 500 MA X-ray was installed and activated. A microbiological capability was added.

3. Buildings

The Satellite Operations Branch moved from Building 1201 to Building 1265 in September. Colonel Hessberg's office, the Administration Branch, the Library, and the Illustrator's office moved ~~from~~ TO Building 1265 in October.

4. Equipment

In September, the Laboratory received a verifax machine. This assisted greatly in the workload of the "papermill".

5. Management Improvement

A new system for handling classified material was set up in the Administration Branch. A folder for each Branch was placed in the files, and a designated representative from each Branch was appointed to be responsible for picking up classified distribution. The material is logged in and out as each Branch makes use of it and hand receipts are kept on file in the Administration Branch.

6. Meetings, Conferences, Symposiums

24-31 August: Dr. von Beckh read a paper at the Ninth International Astronautical Congress entitled "Flight Experiments about Human Reactions to Accelerations Which are Followed or Preceded by Weightlessness" at Amsterdam, Holland.

5-7 September: Dr. von Beckh read the same paper translated into German at the International Space Meeting of the German Rocket Society.

7. Special Features

During the reporting period six officers and six airmen were placed on flying status as non-crew members to support the new mission of the Laboratory. The officers are Capt Archibald, Capt Cook, Capt Parks, Capt Recht, Lt Miksch, and Capt Corkhill. The airmen are MSgt Ferguson, MSgt Pierce, TSgt Gatewood, TSgt Dittmer, SSgt Wiedeman and A/2C Martinez.

1959

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AIR FORCE MISSILE DEVELOPMENT CENTER

TECHNICAL REPORT

(Unclassified Title)

SARV I STRATOSPHERE CHAMBER TEST

Joseph Byrd

DOWNGRADED AT 3 YEAR INTERVALS;
DECLASSIFIED AFTER 12 YEARS
DOD DIR 5200.10

[illegible]

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HOLLOMAN AIR FORCE BASE
NEW MEXICO

September 1959

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Project 6892

(Unclassified Title)

SARV I STRATOSPHERE CHAMBER TEST

by

Joseph Byrd

DOWNGRADED AT 3 YEAR INTERVALS:
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DOD DIR 5200.10

Technical Services Division

Directorate of Advanced Technology

AIR FORCE MISSILE DEVELOPMENT CENTER
AIR RESEARCH AND DEVELOPMENT COMMAND
UNITED STATES AIR FORCE
Holloman Air Force Base, New Mexico

September 1959

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ABSTRACT

The Stratosphere Chamber was used to simulate environmental conditions of the Satellite Aeromedical Recovery Vehicle, Weapons System 117L Sub L, Project Discoverer, and supported Project 6892 of the Aeromedical Field Laboratory. The temperature and altitude of the chamber were programmed to simulate the take-off, orbit, and re-entry of the life cell inside the missile nose cone. ~~(S)~~

Two tests were performed on the specimen on 11 and 18 January 1959, respectively. An infrared hemispherically shaped furnace was used to heat the specimen. This furnace was designed by Stratosphere Chamber engineers for this particular test specimen. (U)

This report contains the factual data of this environmental test, a performance report on the Stratosphere Chamber, and design information concerning the infrared furnace. (U)

PUBLICATION REVIEW

This Technical Report has been reviewed and is hereby approved for publication.

FOR THE COMMANDER:

KNOX MILLSAPS
Chief Scientist

TABLE OF CONTENTS

Page

I. INTRODUCTION AND PURPOSE 1

II. FACTUAL DATA 2

A. Description of Apparatus 2

B. Description of Tests 6

C. Results. 10

III. DISCUSSION 10

A. Analysis of Results. 10

B. Practical Application of Results 14

LIST OF ILLUSTRATIONS

Figure

1. Infrared Furnace 3

2. Schematic, Automatic Temperature Control 5

3. Thermocouple Locations, Test No. 1 7

4. Thermocouple Locations, Test No. 2 8

5. Stratosphere Chamber Tests, Curve No. 1-A. 11

6. Stratosphere Chamber Tests, Curve No. 1-B. 12

7. Stratosphere Chamber Tests, Curve No. 3. 13

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SARV I STRATOSPHERE CHAMBER TEST

I. INTRODUCTION AND PURPOSE

A. Introduction

The preparation for these tests involved slide times dating back to 15 October 1958. Oral discussion with the Aeromedical Field Laboratory project officers concerning the abilities of the Stratosphere Chamber to meet the requirements to test Aeromedical Field Laboratory test specimen SARV I, began about 1 September 1958. At that time it was decided to initiate preliminary tests not later than 15 October 1958, and to begin actual environmental chamber tests not later than 15 November 1958. (U)

The SARV I project, 6892, was authorized to use the Department of Defense priority rating D-X.01 Brickbat. The Stratosphere Chamber Branch used this rating to obtain necessary test equipment for the project. (U)

The Stratosphere Chamber Branch received no final test plan from Aeromedical Field Laboratory. All test plans were presented by oral discussion. The test specimen outer shield arrived at the Air Force Missile Development Center about 24 December 1958. This shield (which would be used around the test package in actual tests) was used for preliminary testing purposes. The first live test, SARV I Test No. 1, was started on 11 January 1959. SARV I Test No. 2, was run on 18 January 1959. (U)

B. Purpose

~~(S)~~ The purpose of the Stratosphere Chamber tests was to simulate the environmental conditions encountered during take-off, orbit, and re-entry by the SARV I animal-inhabited satellite capsule, and to determine whether or not the biological specimens would survive under such conditions. ~~(S)~~

Released by author, 28 April 1959.

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II. FACTUAL DATA

A. Description of Apparatus

1. The part of the test specimen that concerned the Stratosphere Chamber was the 1/4-inch aluminum external shield that was used around the inner life cell during the tests. This shield, furnished by General Electric, represented the nose cone of the missile that would carry the life cell in actual flight. One single point on the inner surface of this 26-inch hemisphere was selected as the temperature control point, located 6.4 inches from the nose of the shield on the sun side of the specimen. The biological life cell was placed inside the shield during the chamber tests. ~~(U)~~

2. The Stratosphere Chamber Branch engineers designed, and had fabricated, an infrared furnace. General Electric quartz crystal lamps (T3) were arranged in a hemispherical order approximately five feet in diameter. This furnace was designed to be used to test SARV I. Its design was based on the following oral information from Aeromedical Field Laboratory project officers: (U)

a. The part of the specimen to be heated during chamber tests would be a hemisphere 39 inches in diameter. (U)

b. The outer surface of the specimen would be a thin gauge aluminum (or similar). (U)

c. Maximum heating requirements would be to obtain a temperature rise of 900°F in six minutes on the surface described above. (U)

The furnace, 94 kw of heating power, was designed to perform the above heating requirements. Using the surface area of the 39-inch hemisphere, constructed from thin gauge aluminum, the wattage density of heat required to give the 900°F temperature rise (approximately 20 watts per square inch on the specimen surface) was determined from empirical nomographs in General Electric Bulletin LS-128, "Infrared Lamps and Their Applications." (Fig. 1.) (U)

FIGURE 1. INFRARED FURNACE

According to this General Electric bulletin the lamp filaments should be eight inches away from the specimen surface for optimum results. The NASA report, "Experimental Research on Aircraft Structures at Elevated Temperatures," was used to confirm the above calculations. The furnace was designed according to the above information and was fabricated in the Field Maintenance Sheet Metal Shop of Holloman Air Force Base. Approximately 480 engineering manhours were spent on the design and fabrication of this furnace; its total cost, including material, was approximately $3,000. (U)

When the actual specimen arrived at the chamber, its outer shield was a hemisphere only 26 inches in diameter and it was constructed from 1/4-inch heavy gauge aluminum. Therefore, the infrared furnace was not used to heat the specimen it had been designed for, but, nevertheless, it performed very satisfactorily. (U)

3. The test requirements called for heating the entire specimen surface during take-off, programming the sun side and the earth side separately during orbit, and heating the entire specimen surface during re-entry. The sun side of the specimen represented the side (one-half of the hemisphere) that would be heated by the sun during orbit; the earth side would be away from the sun; therefore, cooler than the sun side. The sun side was to be heated with a sinusoidal temperature program; the 90-minute cycle period represented an orbit around the earth. Maximum temperature of 100°F would be reached when the satellite was nearest the sun, and minimum temperature of -30°F when the satellite was most distant from the sun. The infrared lamps on the furnace were wired to meet the above test requirement. The lamps were divided into four electrical circuits; the furnace was divided into half-hemispherical sections, one section representing the sun side and the other section representing the earth side. On the sun side, one-third of the lamps were connected to a control circuit to program the temperature at the control point; the remaining two-thirds of the lamps were connected to a manually operated, 480-volt circuit to be used for maximum heat during re-entry. The earth side was similarly connected in two circuits, making a total of four circuits (fig. 2). ~~(C)~~

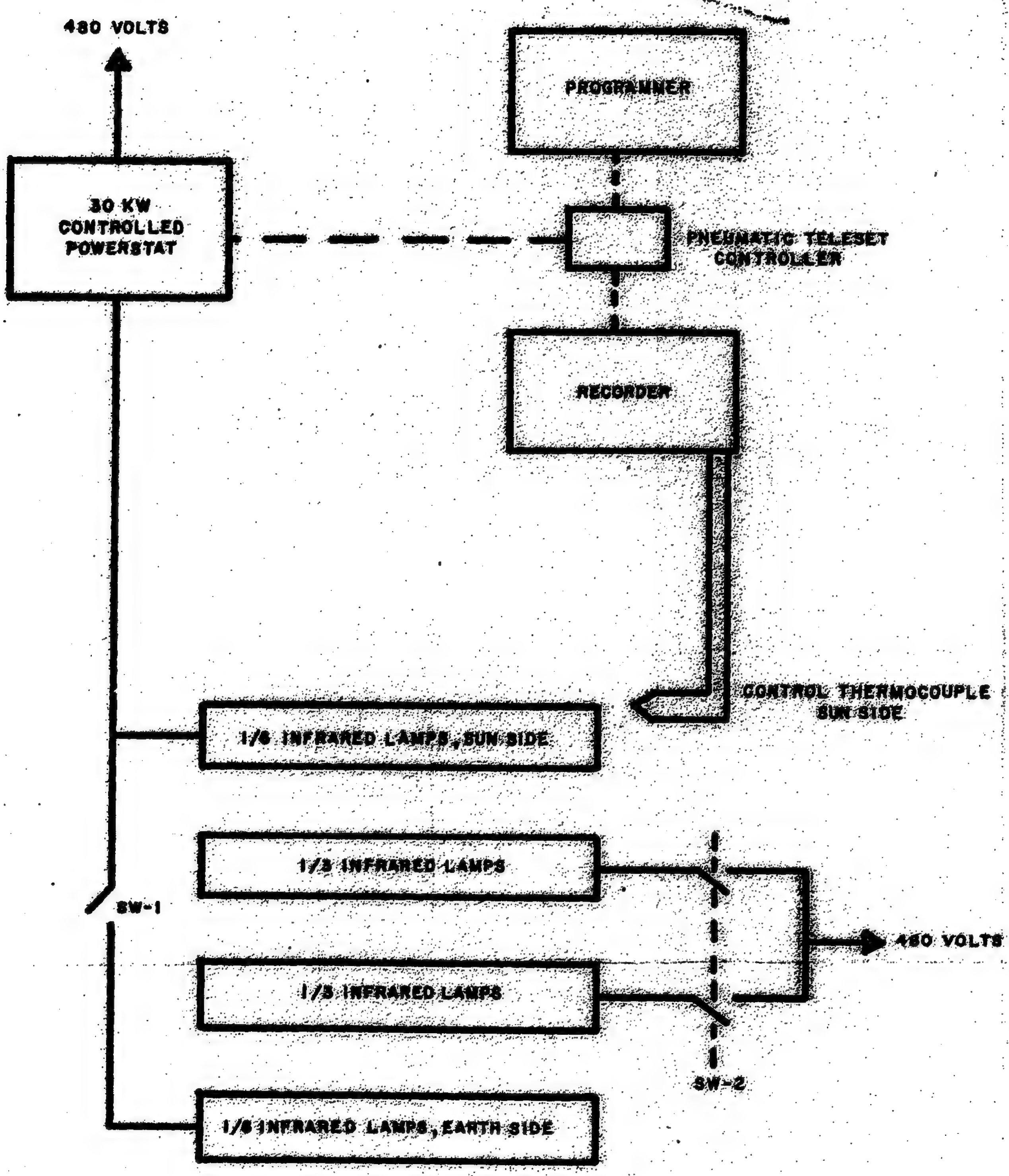
480 VOLTS
30 KW CONTROLLED POWERSTAT
PROGRAMMER
PNEUMATIC TELESET CONTROLLER
RECORDER
CONTROL THERMOCOUPLE SUN SIDE
1/6 INFRARED LAMPS, SUN SIDE
1/3 INFRARED LAMPS
1/3 INFRARED LAMPS
SW-1
SW-2
480 VOLTS
1/6 INFRARED LAMPS, EARTH SIDE

FIGURE 2

SCHEMATIC, AUTOMATIC TEMPERATURE CONTROL

4. The infrared furnace was suspended from the ceiling of the chamber with chains; the open section of the hemisphere faced the chamber ceiling. The furnace was originally designed for the open section to face horizontally, based on information given by Aeromedical Field Laboratory project officers. The SARV I outer shield was also suspended by chains from the chamber ceiling and hung centered inside the furnace. (U)

5. The 6.4 station point control temperature, sun side outer shield, was programmed with the chamber dry bulb controller system. This unique control system used a Minneapolis-Honeywell Brown controller and recorder pneumatic control circuit. The pneumatic output pressure regulated a 30 kw powerstat that was connected to the lamp control circuit on the infrared furnace. The desired sinusoidal control temperature curve was plotted with India ink on the controller chart; this sinusoidal curve was for a period of 90 minutes and minimum and maximum temperatures of -30°F and 100°F. A photoelectric curve-follower scanned this program and controlled the heaters. (U)

The chamber altitude control was similar to the temperature control; the pneumatic control pressure regulated an air bleed valve that allowed the chamber to maintain a controlled altitude. (U)

6. Thermocouples were installed in the chamber and on the test specimen at specific points desired by Aeromedical Field Laboratory (fig. 3 and 4). The automatic data logger and Brown multipoint recorders were used to monitor and record the temperatures. During Test No. 2, five thermocouples were installed inside the life cell of the specimen. The thermocouple sensing points were insulated electrically with Scotch electrical tape and fastened to the points with drafting tape. The altitude was monitored by means of an Alphatron sensing element and a Brown recorder. (U)

B. Description of Tests

1. Preliminary Tests

(S) After the external shield of the specimen had been obtained from the Aeromedical Field Laboratory, it was installed

FIGURE 3

THERMOCOUPLE LOCATIONS

TEST NO. 1 11-12 JAN 59

PURPOSE	RECORDER	CHANNEL
6.4 CONTROL POINT	AUTO DATA LOGGER	DRY BULB
SHELL, OPPOSITE CONTROL POINT	AUTO DATA LOGGER	1
SHELL, 90° cw FROM C.P.	AUTO DATA LOGGER	2
SHIELD, NOSE	AUTO DATA LOGGER	3
SHELL, 180° cw FROM C.P.	AUTO DATA LOGGER	4
CHAMBER WALL, LEFT	AUTO DATA LOGGER	5
CHAMBER FLOOR	AUTO DATA LOGGER	6
CHAMBER CEILING	AUTO DATA LOGGER	7
SHELL, 270° cw FROM C.P.	AUTO DATA LOGGER	8
LIFE CELL COVER	AUTO DATA LOGGER	9
LAG BOX TEMPERATURE	AUTO DATA LOGGER	10
ALTITUDE	AUTO DATA LOGGER	ALTITUDE
6.4 CONTROL POINT	SANBORN	8
6.4 CONTROL POINT	DRY BULB	DRY BULB
6.4 CONTROL POINT	HIGH TEMP. BROWN	1
CHAMBER CEILING	20 pt. BROWN	11
CHAMBER FLOOR	20 pt. BROWN	18
SHELL, OPPOSITE CONTROL POINT	20 pt. BROWN	9
SHELL, NOSE	20 pt. BROWN	5
ALTITUDE	SANBORN	7
ALTITUDE	BROWN	1

FIGURE 4

THERMOCOUPLE LOCATIONS

TEST NO.2 18 JAN59

PURPOSE	RECORDER	CHANNEL
6.4 CONTROL POINT	AUTO DATA LOGGER	DRY BULB
SHELL, OPPOSITE CONTROL POINT	AUTO DATA LOGGER	1
SHELL, 180° cw FROM C.P.	AUTO DATA LOGGER	2
SHIELD, NOSE	AUTO DATA LOGGER	3
INSIDE SPECIMEN I	AUTO DATA LOGGER	4
CHAMBER WALL, LEFT	AUTO DATA LOGGER	5
CHAMBER FLOOR	AUTO DATA LOGGER	6
CHAMBER CEILING	AUTO DATA LOGGER	7
INSIDE SPECIMEN II	AUTO DATA LOGGER	8
INSIDE SPECIMEN III	AUTO DATA LOGGER	9
LAG BOX	AUTO DATA LOGGER	10
ALTITUDE	AUTO DATA LOGGER	ALTITUDE
INSIDE SPECIMEN IV	20 pt. BROWN	8
SHELL, OPPOSITE C.P.	20 pt. BROWN	9
6.4 CONTROL POINT	20 pt. BROWN	10
CHAMBER CEILING	20 pt. BROWN	11
SHELL, 90° cw FROM C.P.	20 pt. BROWN	12
SHELL, 270° cw FROM C.P	20 pt. BROWN	13
INSIDE SPECIMEN V	20 pt. BROWN	14
SHIELD, EARTH SIDE	20 pt. BROWN	17
CHAMBER FLOOR	20 pt. BROWN	18
6.4 CONTROL	SANBORN	8
ALTITUDE	SANBORN	7

3

in the chamber and several preliminary tests were performed. The most revealing of these tests were performed on 5 December and 23 December 1958. On 5 December preliminary test No. 5 was run; this was a 330-minute test, including take-off, three cycles of orbit, and re-entry. It was discovered from this run that the specimen would not cool down as fast as the General Electric control point curves predicted. Also, the external surface of the shell was hotter than had been predicted. The earth side temperature could not be programmed as had been planned, since the temperature, with no heat applied, was always hotter than the program temperature. This was caused by heat conducting around the nose cone through the thick surface. On 23 December preliminary test No. 6 was run; this test was similar to test No. 5, except that an entirely new General Electric calculated control point program curve was used. Similar results were obtained. Other tests preceding tests No. 5 and 6 also furnished very important information. It was discovered that if the altitude were above 92,000 feet, the infrared furnace electrical conductors would arc to ground when at full voltage (500V a.c.). Therefore, it was decided to have the chamber below 90,000 feet during heating cycles. Also, high temperature tests were run; full heat for 10 minutes resulted in approximately a 600°F temperature rise on the specimen external shield. This was with the shield unpainted. Since it was decided that this long-duration heating was not required, no further attempts were made to increase the temperature rise. ~~(S)~~

2. SARV I, Test No. 1, 11 and 12 January 1959

~~(S)~~ The specimen was installed in the chamber at 0650, the 6.4 control point was automatically held at 100°F until take-off at 0825. During this time the chamber cold walls were brought down to approximately -75°F to provide the cooling necessary during the cool-down portion of the cycle. The control point was programmed from 100°F to 160°F in five minutes during the take-off and then into the orbital 90-minute cycles - minimum temperature -30°F and maximum temperature 100°F. The temperature control curves were plotted on the programmer charts from curves calculated by General Electric. Altitude was set manually and controlled automatically (in other words there was manual programming but automatic control); it was set at 85,000 feet during heating periods and at maximum during cooling. The maximum altitude reached was approximately 215,000 feet. After take-off and three orbit cycles, a re-entry was simulated. Aeromedical Field Laboratory was doubtful that the specimen's cooling system would operate for more than five hours, because the cooling water solenoid would not close. See figure 5 for results. Orbit was then resumed until the final re-entry at the end of the test. See figure 6 for results. During re-entry maximum heat was applied for 4.5 minutes, then cut off entirely; 400°F maximum was obtained. General Electric curves specified 465°F. The altitude was programmed down to ambient during re-entry, thus ending the test. This altitude curve was supplied by Aeromedical Field Laboratory and plotted on the altitude program chart. (S)

3. SARV I, Test No. 2, 18 January 1959

The specimen was installed in the chamber at 0630. From 0630 until 0745 the external shield control point was automatically controlled (manually set) between 70°F and 85°F. At 0745 the control was set at 100°F and remained at that temperature until take-off time at 0826. The remainder of the test was the same as Test No. 1 on 11 and 12 January 1959. Test No. 2 was terminated at approximately 2000 because the specimen inner capsule was too cold. See figure 7 for results. (S)

C. Results

Both SARV I tests were successful as far as the Stratosphere Chamber tests were concerned. The only portion of the tests that the chamber was unable to perform was the cool-down from +100°F to -30°F in 45 minutes during orbit. (S)

III. DISCUSSION

A. Analysis of Results

(S) Since the specimen was being heated and cooled in orbit while at altitude not below 85,000 feet, the low temperature of the cycle that was programmed, -30°F, could not be obtained. Only +15°F average was reached in the 45 minutes of cool-down (fig. 5, 6, and 7). At these altitudes there was not enough air to give appreciable cooling by convection. Most of the cooling

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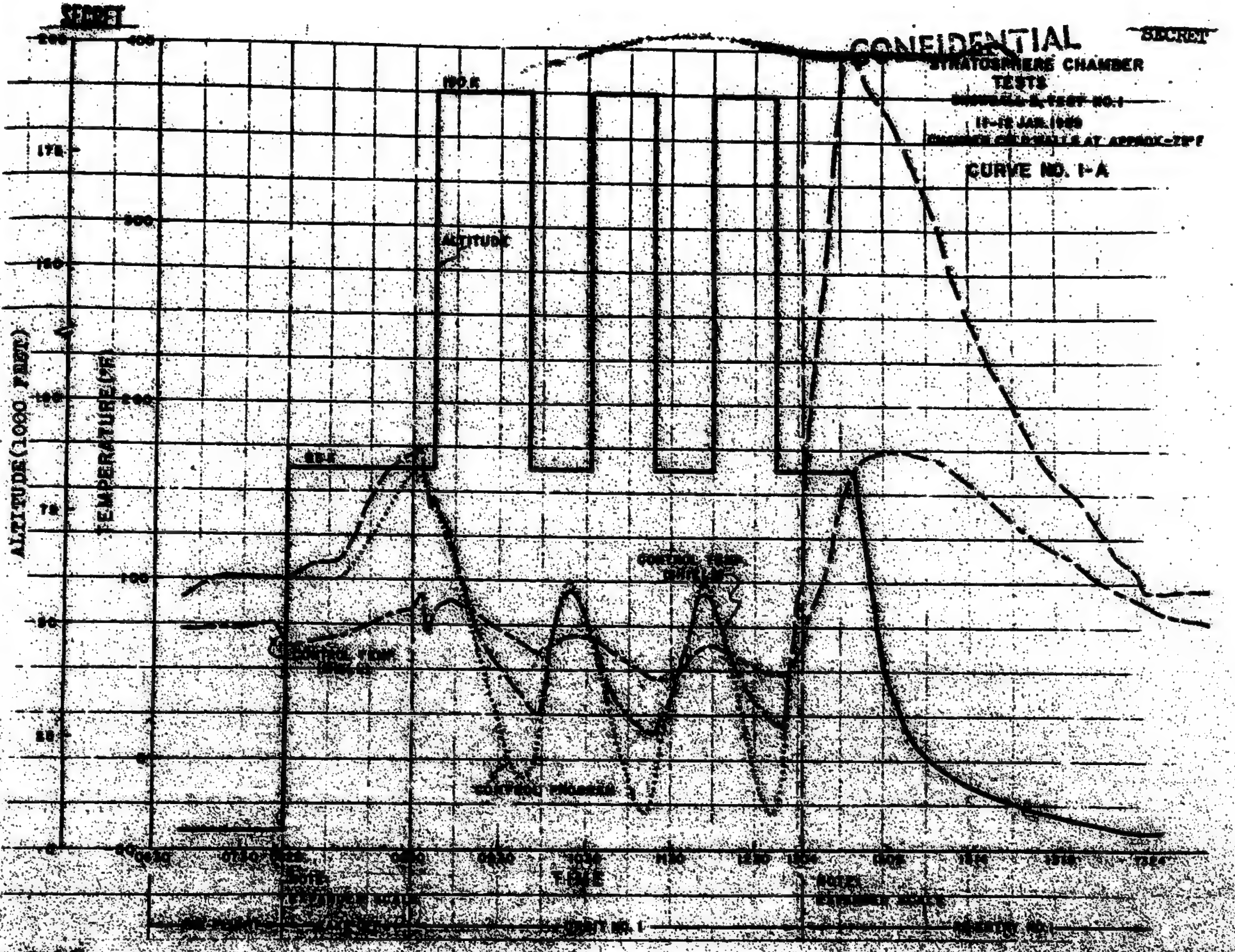

FIGURE 5

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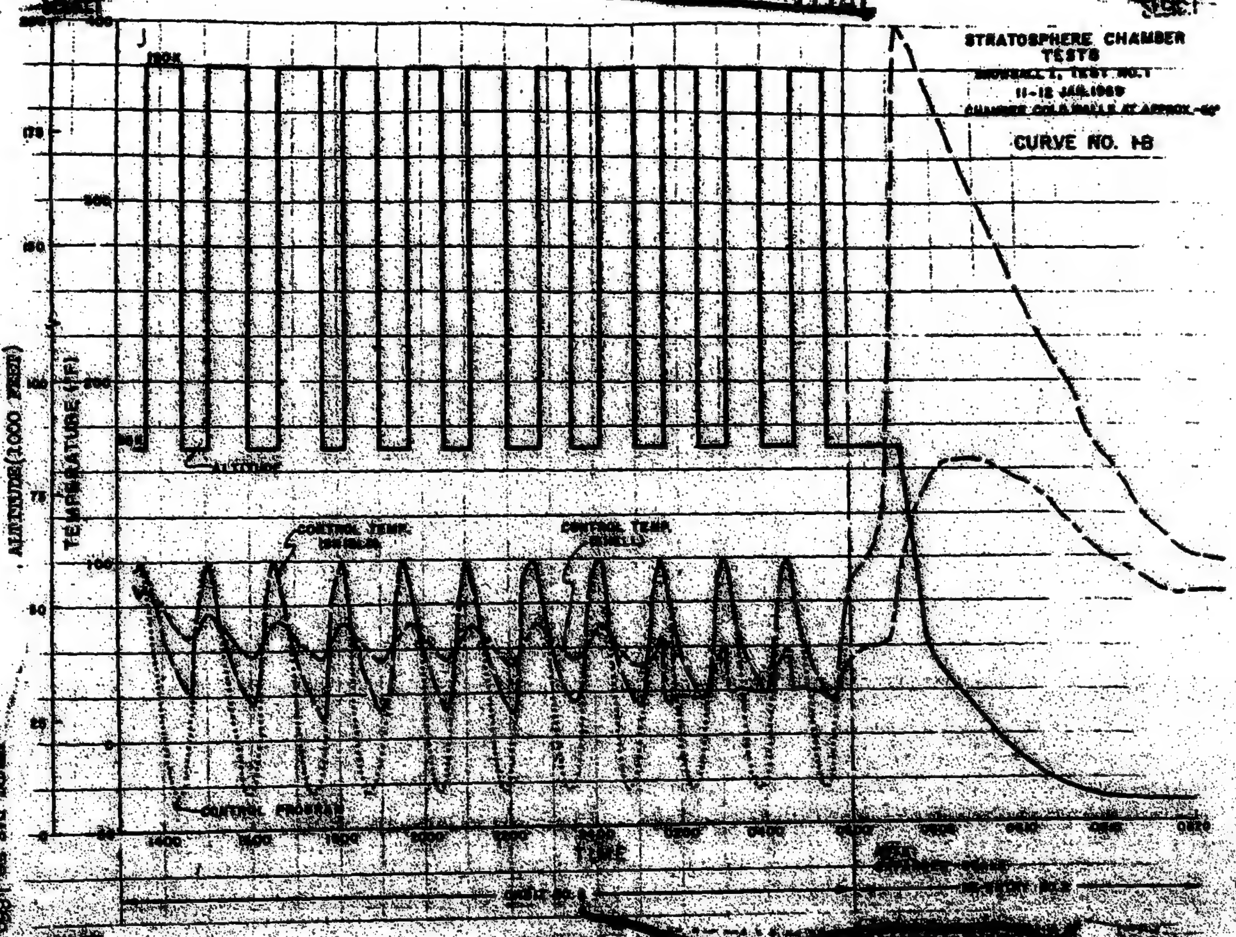

FIGURE 5

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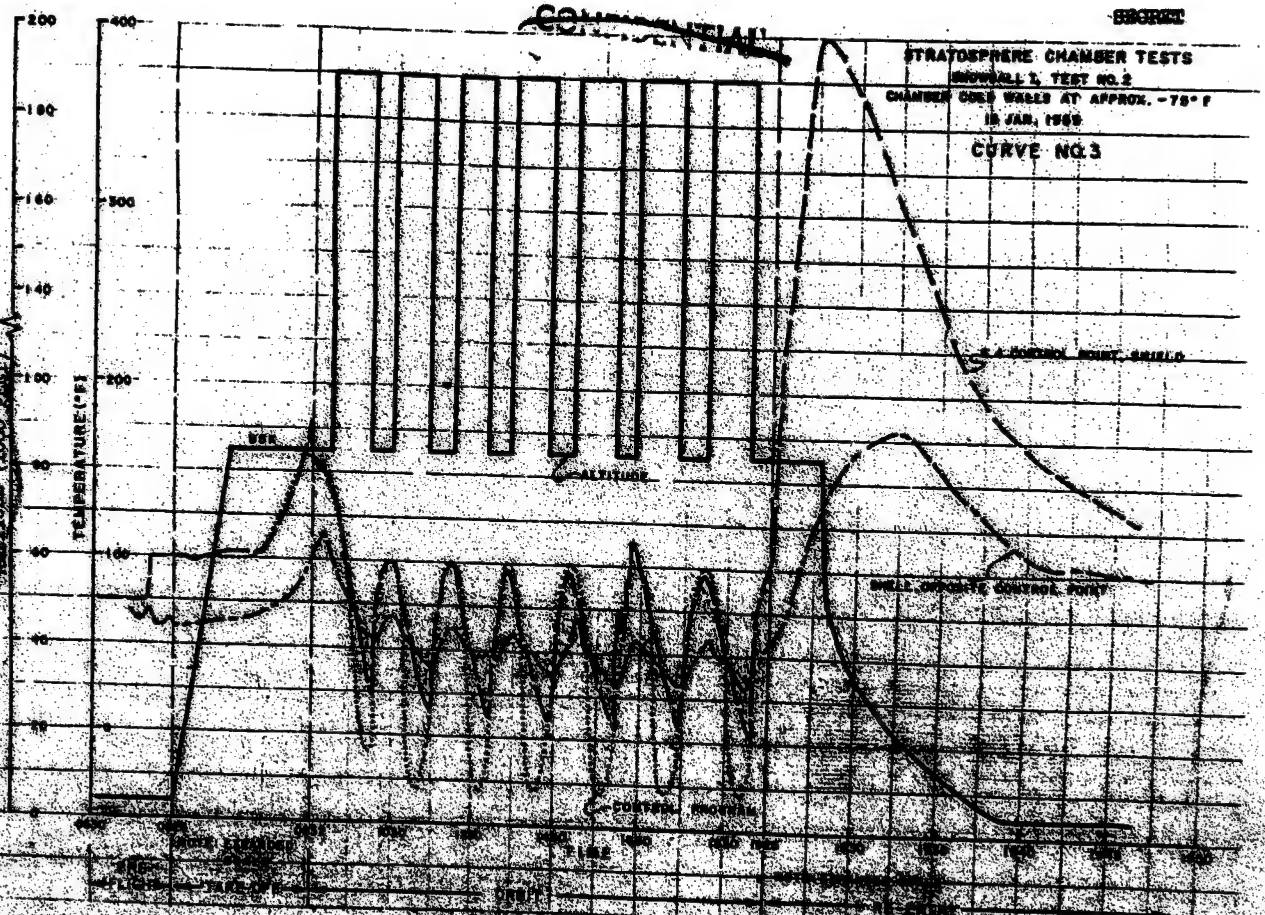

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was accomplished by radiation to the chamber cold walls. The mass of infrared lamps on the furnace around the specimen absorbed and reflected some of the radiant heat around the specimen. If these lamps had not been present, more heat could have been radiated to the chamber cold walls; however, the lamps were necessary to obtain the heat desired. Also, the highly polished reflectors probably reflected back to the specimen some of the heat trying to radiate to the cold walls. If it had been possible to remove the specimen from the furnace during cool-down periods, a close simulation of the programmed cool-down to -50°F could have been obtained. A more elaborate heating furnace that could have been moved from the specimen by remote control during cool-downs, would have been more satisfactory; however, this was not warranted for only one test. ~~(S)~~

The temperature control circuit performed very well throughout the tests. Only minor voltage balance adjustments had to be made to the programmer circuit. The programmer varied from the program curve a few times, but not for a sufficient length of time to cause any noticeable deviation from the program. (U)

After maximum altitude had been pulled several times during orbit cool-down, the chamber could pull a maximum altitude of 100 microns, measured by a McLeod gauge. ~~(S)~~

The chamber maintained its cold wall temperature at -75°F average, with very little difficulty during the long runs. (U)

During the re-entry period only 400°F maximum temperature was reached with full heat for 2.5 minutes, whereas the program called for 465°F. The Aeromedical Field Laboratory project officers did not think this was a serious discrepancy and did not desire to have a three-minute heat-up in order to obtain the 465°F. ~~(S)~~

B. Practical Application of Results

The practical application of the results obtained from the SARV I tests was that the Stratosphere Chamber can be used to simulate closely a satellite flight. ~~(S)~~

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SARV I STRATOSPHERE CHAMBER TEST (U), by Joseph Byrd, September 1959. 16 pp, incl. illus. (Project 6892) (AFMDC-TR-59-34) Secret Report

The Stratosphere Chamber was used to simulate environmental conditions of the Satellite Aeromedical Recovery Vehicle, Weapons System 117L Sub L, Project Discoverer, and supported Project 6892 of the Aeromedical Field Laboratory. The temperature and altitude of the (over)

AFMDC DAS 59-4860

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Holloman AFB, New Mexico

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Two tests were performed on the specimen on 11 and 18 Jan 59, respectively. An infrared hemispherically shaped furnace was used to heat the specimen. This furnace was designed by Stratosphere Chamber engineers for this particular test specimen. This report contains the factual data of this environmental test, a performance report on the Stratosphere Chamber, and design information concerning the infrared furnace. (U) AFMDC DAS 59-4860

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A Model for Behavioral Research with Mice in Biosatellites

MAJOR FREDERICK H. ROHLES, JR., USAF (MSC) and
CAPTAIN MARVIN E. GRUNZKE, USAF

Reprinted from AEROSPACE MEDICINE, Volume 32, Pages 751-755, August, 1961

A Model for Behavioral Research with Mice in Biosatellites

MAJOR FREDERICK H. ROHLES, JR., USAF (MSC) and
CAPTAIN MARVIN E. GRUNZKE, USAF

THE ADVANTAGES of including psychological measures with standard physiological determinations on infra-human organisms participating in orbital flight have been well established.[3] By supplementing one another, the two measures present a complete appraisal of the organism.

While this postulate is true, regardless of the phylogenetic level of the organism participating in the flight, the extent to which behavioral measures can be made on mice is usually considered to be extremely limited. In fact, the knowledge of physiology of the mouse is considerably in advance of the understanding of its behavior. Yet, with the increased use of the mouse in flights beyond our atmosphere coupled with the need for measuring both the physiological and psychological effects of these flights, it became paramount that behavioral processes of this organism be studied. Thus, the purpose of this study was to develop a model for the type of behavioral research that could be done with mice in biosatellites.

PROCEDURE

The subject in this study was a male C-57 BL mouse (Roscoe B. Jackson Laboratories strain), 160 days old, weighing 25 grams at the beginning of the experiment.

A standard operant conditioning chamber was used. The force required to operate the lever, and the height of the lever and food chute were the same as described by Anliker and Mayer.[1] Programming and recording were handled with automatic operant conditioning equipment.

Before the actual training was started, food deprivation procedures were employed until the subject was at 80 per cent of its normal body weight. When the subject reached this weight, magazine training was begun. This consisted of placing the subject in the operant chamber for 30 minutes for five consecutive days and aperiodically feeding it commercial rat food pellets (.047 gram) by means of an automatic pellet dispenser.* The subject was 14 hours hungry during this training. During these periods the interior of the chamber was illuminated with a 6-watt lamp, and an electronic clicker was sounded which presented background clicks at the rate of 180 clicks per minute. During this five-day period, the lever was removed from the chamber. Water was allowed *ad libitum* throughout the course of the experiment.

On the sixth day, the lever was incorporated into the chamber and the subject was rewarded with one food pellet for every lever press. When the subject began to respond to this schedule the ratio of lever presses to rewards was increased gradually until, after approximately four weeks with 30-minute training sessions daily, the subject exhibited consistent and reliable behavior on an FR100 reinforcement schedule (fixed ratio of 100 lever presses for one pellet of food).[2]

Subsequent to the training on the ratio schedule, discrimination training was initiated. Here the animal was trained to differentiate between work periods (time during which responses were rewarded) and rest periods (time when no responses were rewarded). To accomplish this the subject was placed in the darkened chamber for 10 minutes; during this time none of the lever

---

From the Aeromedical Field Laboratory, Holloman Air Force Base, New Mexico.

*This pellet is the product of P. J. Noyes and Co., Lancaster, N. H., and is designed for use in a pellet dispenser manufactured by Davis Scientific Instruments, 12137 Cantura Street, Studio City, California.

presses was rewarded. Following this period, the light and clicker were activated for 20 minutes and served as cues for the work period, or time during which performance on the FR100 reinforcement schedule was rewarded. When the work period was over, the lamp and clicker were turned off and the subject remained in the chamber for 10 more minutes; none of the responses was rewarded during this period. The subject was returned to its home cage after each of these sessions.

After approximately seven days, responses during the 10-minute periods before and after the work periods were reduced to such a degree so as to give evidence that the subject was discriminating between the work and rest periods. The duration of the rest periods was then increased gradually so that after approximately five weeks, the length of the rest period was 5 hours and 40 minutes.

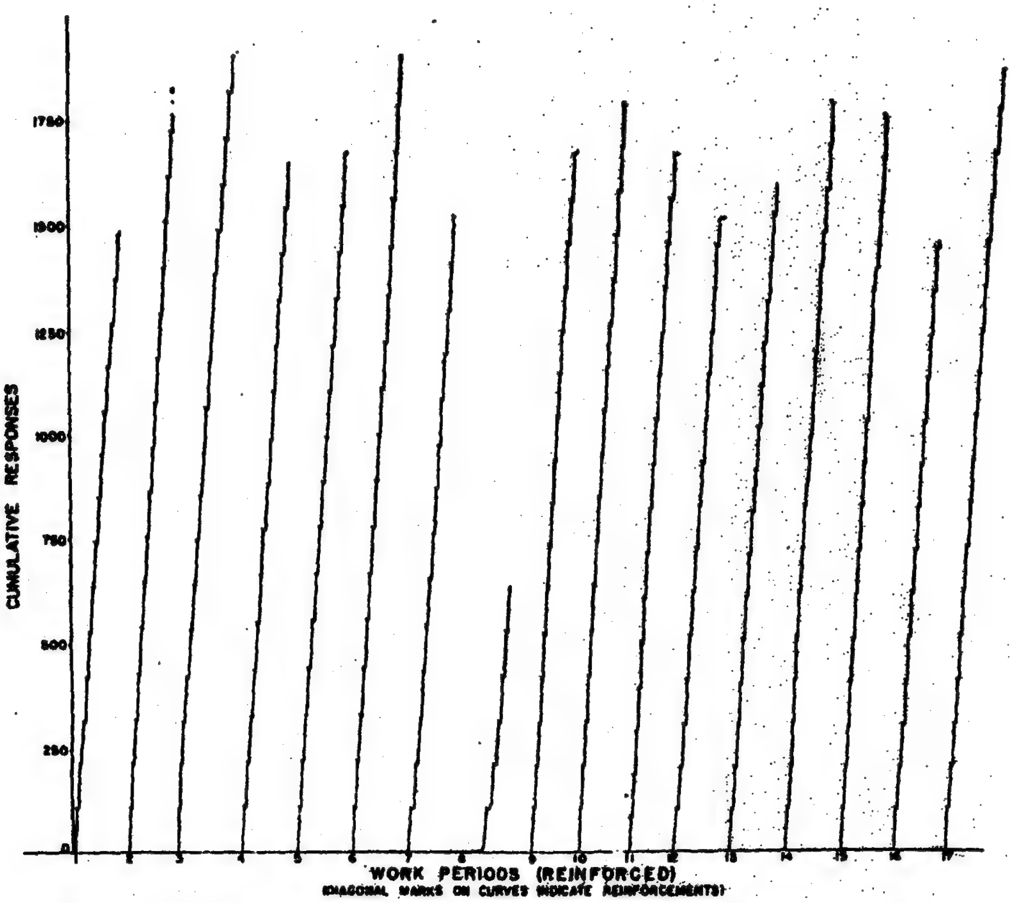

Fig. 1. Cumulative response curves for seventeen 20-minute work periods during the four-day reinforcement session.

With the subject responding well on this 6-hour cycle, the next step was to simulate the isolation aspects of the satellite environment. To do this, the operant chamber was placed in a portable ice chest which, in turn, was placed in a portable testing room of double-walled soft fiber board construction. This room was located in a small laboratory room that was lined with acoustical tile. All programming and recording equipment was located outside the laboratory room. The subject was placed in the chamber and remained in this isolated environment throughout the experiment. The work-rest intervals were the same as described above: a repeating 6-hour cycle consisting of a 20-minute work period in which the lamp and clicker were activated and responses were rewarded on a FR100 reinforcement schedule, and a rest period of five hours and 40 minutes in which both the lamp and clicker were turned off and none of the responses was rewarded.

The subject remained on this 6-hour cycle for seventeen work periods or 96 hours and 20 minutes. Following this period the electrical power that controlled the feeder in the operant chamber was turned off at the programming unit and the subject remained in the chamber for an additional 96 hours in order to measure performance under non-reward or extinction conditions. This procedure eliminated all secondary reinforcement orginating from the operation of the feeder solenoid. During the extinction sessions the 6-hour repeating cycle remained in effect; the light and clicker were employed the same as they were during the reinforced periods. The only difference was that none of the responses during this 96-hour period was rewarded.

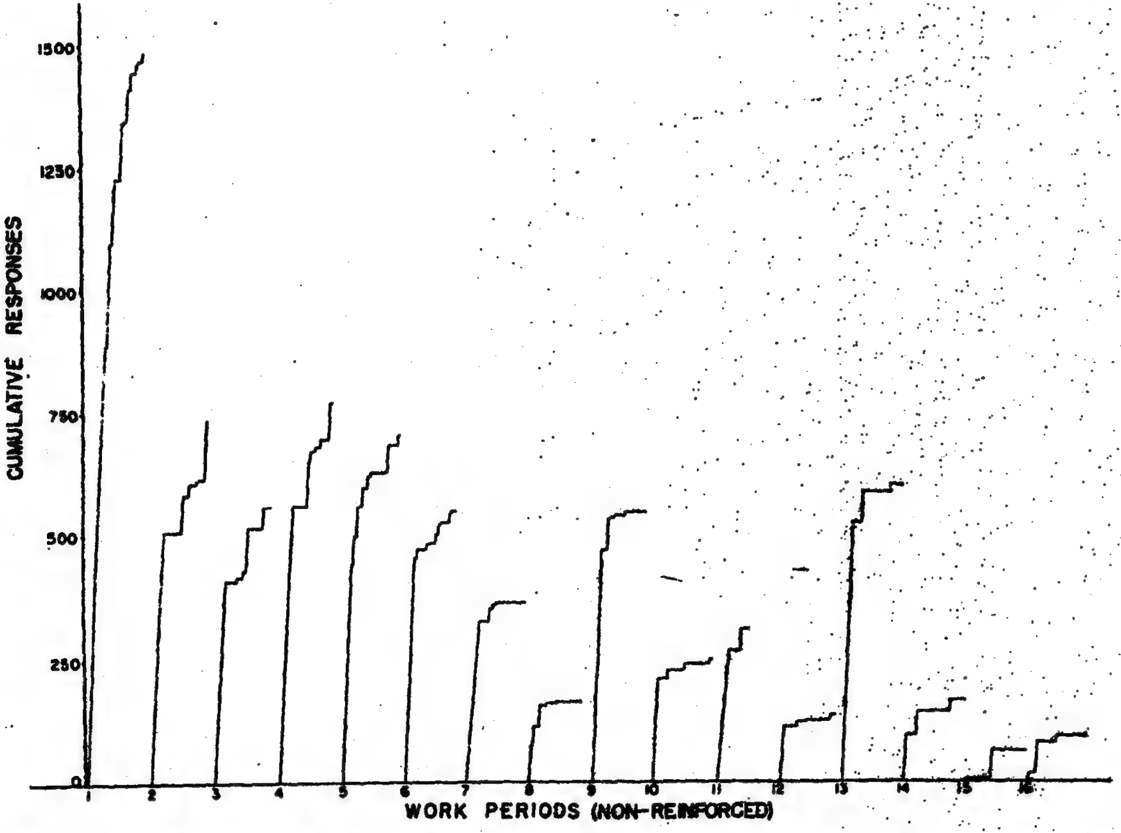

Fig. 2. Cumulative response curves for sixteen 20-minute work periods during the four-day extinction session.

RESULTS AND DISCUSSION

The cumulative response curves for the seventeen reinforced work periods are shown in Figure 1. Consistent with the behavior of other species, the response rate of this subject was high and reliable from work period to work period. In only one work period did the performance show any noticeable decrement.

The cumulative response curves for the sixteen non-reinforced work periods are shown in Figure 2. As expected, the highest response frequency and most sustained response rate occurred during the first non-reinforced work period. Those following showed a marked decrement. However, it is notable that after three days without food (period 13) the subject still showed a high response frequency.

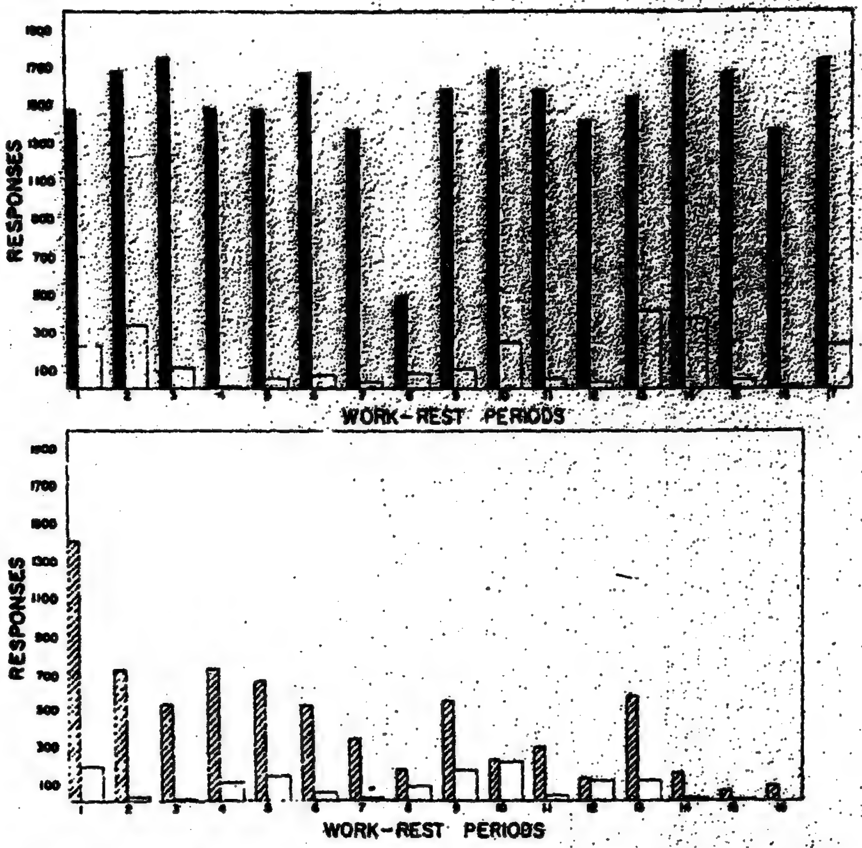

Fig. 3. Response frequency by period for the eight-day session. (Solid bars indicate responses during the 20-minute work periods when food was rewarded on FR100 schedule; crosshatched bars indicate responses during the 20-minute work periods when no reward was given; white bars indicate responses during the 5-hour, 40-minute rest periods.)

Response frequencies for the entire eight-day period are shown in Figure 3. It should be pointed out that the majority of the responses during the 5-hour, 40-minute rest periods were made immediately following the 20-minute work period. In addition, the response frequencies during the reinforcement sessions tend to show rhythmical tendencies which could be attributed to the diurnal cycle.

Although other investigators have trained mice to perform on ratio reinforcement schedules, several problems were encountered in insuring the sustained performance described in this paper. During the magazine training it was found that a 14-hour food deprivation period was more satisfactory than 18 hours or the customary 22 hours used with rats. Also the response-to-reward ratio was increased very gradually and only when the animal was responding on FR20 were large increments of the ratio introduced. As indicated above, training to discriminate between the work and rest periods was also done very gradually. The 6-hour cycle, which was arbitrarily selected, proved to be satisfactory as was the 20-minute work period.

Future plans call for using several subjects on reduced and staggered work-rest cycles; this would increase the reliability of the results and insure near-continuous recording of information.

The C-57 BL strain was selected for three reasons: first, animals of this strain showed no detrimental effects during high-altitude balloon flights; second, their fur, which is black, turns white when exposed to cosmic radiation; and third, they are not susceptible to audiogenic seizures. The latter becomes of paramount importance since during launch the satellite occupant will be subjected to extremely high noise levels. In our laboratory several groups of these mice have been exposed to 140 db of wideband noise for periods as long as 2 minutes and showed no evidence of sound-precipitated convulsions.

It is believed that there are implications for both space work and other fields in this experiment. It was shown that it is possible to obtain consistent and reliable behavior from a mouse for a period up to 96 hours; there is no reason to doubt that with continued reinforcement this period could be extended. It also demonstrates that complete response extinction is slow under this procedure and that meaningful behavioral information can be obtained in the absence of reward. Concerning other disciplines, a 3- or 4-hour cycle could be used for assessing the behavioral effect of drugs and exposure to unusual environmental conditions such as prolonged acceleration or vibration could also be measured with this design.

SUMMARY

As a model for obtaining behavioral measures with animals in outer space, sustained operant behavior was observed in a mouse that performed on a FR100 reinforcement schedule for 20 minutes out of 6 hours for 96 hours. The performance continued for an additional 96 hours in the absence of reward. It was concluded that this type of performance can be obtained from a mouse for prolonged periods of time and that the behavior is highly reliable and consistent from work period to work period.

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1. Anliker, James, and Mayer, Jean: An operant conditioning technique for studying feeding-fasting patterns in normal and obese mice. J. *Appl. Physiol.*, 8:667-670, (May) 1956.
2. Ferster, C. B. and Skinner, B. F.: Schedules of Reinforcement. New York: Appleton-Century-Crofts, 1957.
3. Rohles, F. H., Belleville, R. E. and Grunzke, M. E.: The measurement of higher intellectual functioning in the chimpanzee and its relevance to the study of behavior in space environments. *Aerospace Med.*, 32:121-125, 1961.

3. PROGRESS OF PROJECTS AND TASKS.

a. Project 7850, "Biodynamics of Flight"

The Bopper was used for 26 experiments this month. Human subjects were exposed to 15G in the backward facing position with standard EKG and a respiration sensor added to coordinate the two physiological responses. Of this group, five were atropinized to evaluate this sensor - EKG correlation. The data is being reduced.

b. Task [illegible], "Altered Environments for Biological Specimens"

One chimpanzee data acquisition flight was successfully flown on 17 November 1961.

Four oxygen toxicity tests were completed on 8 November. The statistical analysis was completed and the writeup of the technical report will be written soon.

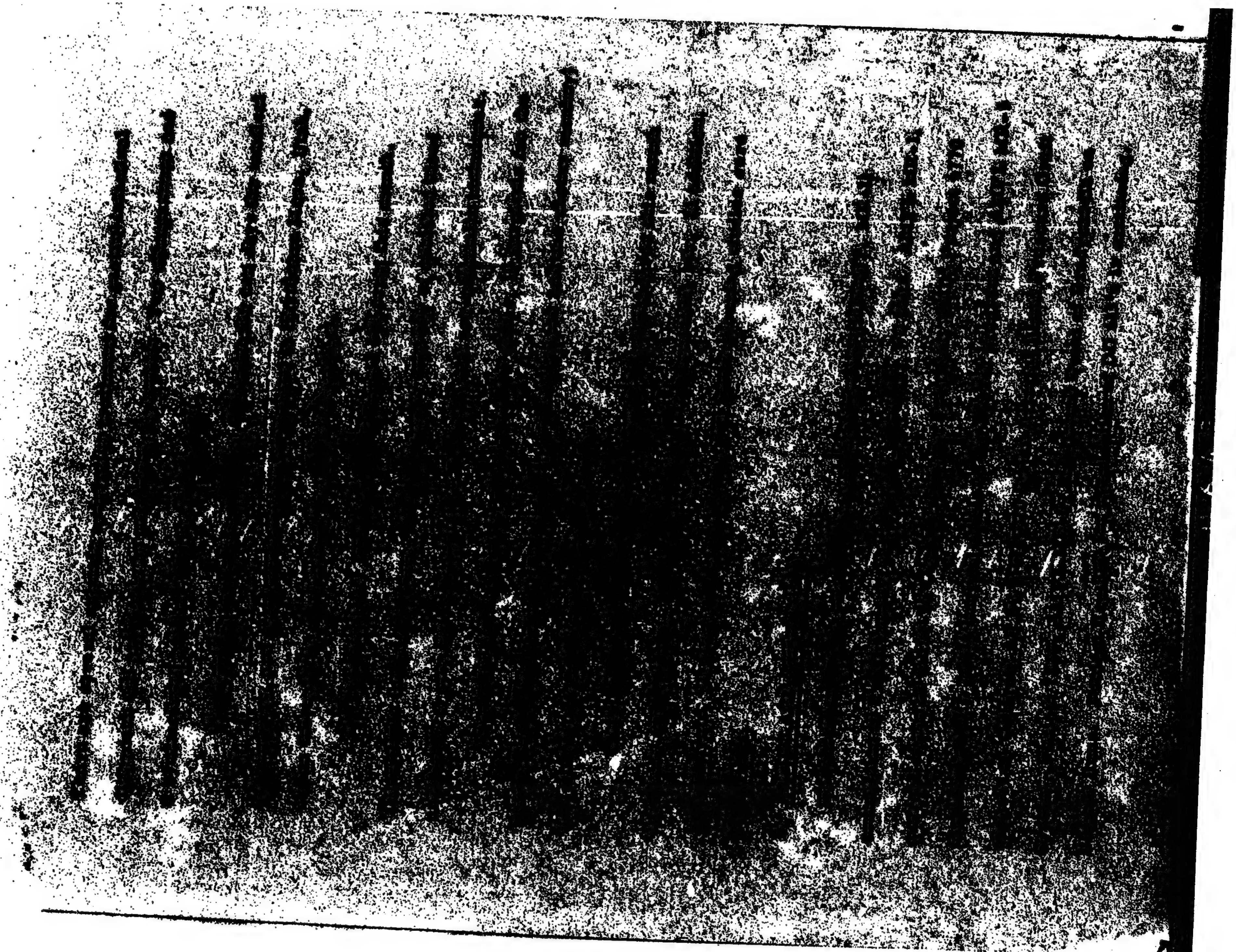
c. Task [illegible], "Biophysical Measurements"

Electronic instrumentation to record 13 channels of information on magnetic tape was furnished to collect data on oxygen tolerance tests.

Work continues on other data collection systems for Bioinstrumentation Research such as VIDAT and a paper tape system for psychological experiments.

4. GENERAL.

At the end of the month the Vivarium is accountable for 156 zoological specimens of five different species: 9 cynomolgus, 22 squirrel monkeys, 22 old world monkeys, [illegible] chimpanzees and 46 mice. The health and welfare of experimental animals housed in the Vivarium is considered excellent.



6. PROCUREMENT

P-680 and P-690 budget reviewed for Project 6592. The Procurement Officer attended four pre-initiation meetings, prepared four PR's, 12 reprogramming actions, the monthly P690 analysis and report, 50 procurement actions. Paperwork was prepared on one contract completion, one contract termination and two contract overruns.

MDKO

Activity Report, June 1962

AFSC (SCGB-3/LtCol Hessberg)

1. Four chimpanzee data acquisition flights were flown using two subjects during each flight.

2. Two Korean medical officers visited the Laboratory.

3. Major [illegible] was accepted as a non-paid member of the faculty of Texas Technological College.

4. Dr. [illegible] of Lubbock, Texas gave a presentation on drug use in behavioral research.

5. Three animals were sent to Texas Tech for training.

6. The RFVAE was rewritten for FY63.

7. Two chimpanzees were tested under [illegible] on the High Speed Track and the Daisy Decelerator in connection with the Mercury Project. All tests were successful.

8. LtCol [illegible] and Capt [illegible] conferred with Lockheed Missile Systems Division at Sunnyvale, California on the [illegible] project interfaces and instrumentation requirements.

9. A [illegible] animal [illegible] cell was [illegible] at the G. E. plant. There were no [illegible]. When the cell was opened the animal was [illegible].

10. Personnel departed for [illegible] systems with high-altitude balloons [illegible].

11. The Geophysics Panel of the Scientific Advisory Board met here on 20 June 1962.

12. Work on the Circular Track progressed [illegible].

13. A contract was signed [illegible] of the VIDAT system.

14. The Hyge shock tester [illegible] installed and is now operational.

15. Mercury [illegible] of the Cape during the last week of June.

16. The NASA [illegible] the capability of the [illegible] was signed.

17. The [illegible] Laboratory. [illegible] Research Director, [illegible] as Director of [illegible] Test Facilities and [illegible]

FOR THE [illegible]

HAMILTON [illegible]
Lieutenant, [illegible]
Director, [illegible]

5-7-61

Hq AFSC Monthly Report-April 1961

I. Technical Accomplishments

A. Vet Serv Br: SIGNIFICANT EVENT

In response to a question raised by members of the National Research Council, the Veterinary Services Branch, Aeromedical Field Laboratory, AFMDC, under Project 6892, "Bio-Medical Tests", has initiated an in-house research program on the sweat characteristics of the chimpanzee using standard clinical perspiration test techniques. Data gathered to date indicates that chimpanzees do sweat the full length of their backs, on their cheeks and on the chin. Other areas remain to be investigated. Continuation of this program will include investigations of the chimpanzee's total sweat gland pattern, study of the histology of these glands and biochemical analyses of the sweat secretions. This program will allow comparison of the chimpanzee's cutaneous gaseous exchange with the corresponding phase of human physiology and may provide design criteria for space flight couches and capsules. To our knowledge this work has never been done on the chimpanzee.

B. Comp Psy Br: SIGNIFICANT EVENT

The Comparative Psychology Branch, Aeromedical Field Laboratory, AFMDC, under Project 6893, "Animal Performance", has received a testing device for measuring higher intellectual processes in primates. The unit, which was built by Grason-Stadler Incorporated, West Concord, Massachusetts (Contract AF29(600)-2308), features automatic stimulus presentation, reward delivery, and response recording. In addition, programming of the stimulus presentation and recording of the response can be accomplished by IBM card punch machines. This unit, which is a completely new approach to measuring animal behavior, will accomplish automatically the same type of measurement as the Wisconsin General Test Apparatus (a device standard in the field of psychology for over 25 years) which requires continuous operator monitoring.

II. Management Accomplishments

AMFL: SIGNIFICANT EVENT

The Aeromedical Field Laboratory, AFMDC, is currently participating in four specific Bioastronautic Programs. These are: the Project Mercury Animal Program, the Advanced Biomedical Capsule, Project SPURT and Project Bio-Tel. This increase of AMFL participation in specific Bioastronautic Programs has necessitated the creation of a focal contact point for management of the Laboratory's commitments. To meet the above requirement, Major John D. Mosely, VC, 279294, was appointed Special Project Officer for the Aeromedical Field Laboratory on 1 April 1961. His duties will be to coordinate and manage all laboratory plans, schedules and commitments for specific Bioastronautic Programs.

III. NEWS NOTE

Vol 4, 1960-61 LEADERS IN AMERICAN SCIENCE lists the biography of Major Frederick H. Rohles, Jr., Chief, Comparative Psychology Branch, Aeromedical Field Laboratory, AFMDC.

2-7-6

CONFERENCE REPORT

Subject: Coordination of Aero Space Medical Laboratory, WADD, and [illegible] Field Laboratory, AFMDC Projects

Date: 17 and 18 April, 1961

Place: Holloman Air Force Base, New Mexico

Attendees: Colonel H. H. Blackshear - AMFL, Chief
Major E. R. Regis - AMFL, Asst to the Chief
Dr. H. von Beckh - AMFL, Technical Advisor - [illegible]
Mr. H. Feder - AMFL, Technical Advisor - Engineering
Captain F. M. Herrera - AMFL, Plans and Programs
Captain J. McElroy - AMFL, Procurement and Contracting

Dr. von Gierke - ASML, Chief, Bioacoustics Branch
Mr. Stan Birnbaum - ASML, Technical Operations Branch

Project Personnel, AMFL:

Project 6892: Major Cornhill, Project Officer; [illegible] Task 68924; Lt. Ford, Task 68921; Mr. [illegible], Task 68925.
Project 7850: Captain Sending, Project Officer
Project 6893: Major Rohles, Project Officer
Veterinary Services Branch: Captain [illegible], Chief; Captain [illegible], Task 68920; Captain [illegible], Task 68921.

[redacted]

2. Project 6892, AMFL, "Bio-Medical Tests".

ASML personnel pointed out certain wording of paragraph 22 - Requirement. The suggestion was made and agreed to by AMFL personnel that the sentence reading "Data are being collected . . ." should read "Data are being collected from all sources available (military and research organizations as well as the literature) and where required, research is being accomplished on survival and tolerance limits of primates and other biological specimens . . .".

This project requires continued close coordination with ASML.

Task 68920: No ASML comment.

Task 68921: AMFL does not design space capsules. The ultimate objective of this task is to provide data, criteria and parameters to be used to test operational space capsules for manned space flight.

Task 68922: The ASML requests information be forwarded on results obtained from the chimpanzee inner ear contract.

Task 68924: FY 62 future plans for a literature survey of stress tolerance studies has been deleted. No funds are available to renew this procurement.

FY 63 future plans for stress tolerance studies (biochemistry) was discussed. An analysis of the work involved shows no duplication of effort between AMFL and ASML.

AMFL is concerned with testing the adequacy of actual space flight hardware in a biomedical capsule. ASML is concerned with testing the feasibility of laboratory models and integrated support capsules in simulated biomedical space capsules.

Task 68925: Both laboratories suggest a meeting of bio-instrumentation personnel concerned with monitoring environmental stress response be held by Hq AFSC. The purpose of this meeting will be to review existing programs, develop a coordinated bio-instrumentation program for the command and assign areas of responsibility in the bio-instrumentation field.

Task 68926: AMFL's interest in radiation shielding is concerned with new methods such as magnetic fields and possibly anti-particle particles. AMFL has no development in personal shielding devices.

3. Project 7164, ASML, "Aerospace Biology Research".

AMFL notes the absence of a narrative for paragraph 22 - Requirement. Additional discussion is required on paragraph 23. The lack of a Test and Evaluation Approach for this project makes it difficult to give specific comment on this project. Clarification of the scope of the phrase "animal, plant and human experimentation" is anticipated when this Test and Evaluation Approach is written. ASML anticipates writing the paragraph, at which time AMFL will offer coordination comments.

4. Project 6301, ASML, "Aerospace Systems Personal Protection".

AMFL concurs with this project and requests it be listed for interest in this project write-up.

5. Project 7165, ASML, "Health Hazards of Materials and Radiation".

AMFL concurs with this project and requests it be listed for interest in this project write-up. AMFL notes a similar endeavor is being accomplished by SAM (ATC).

6. Project 6373, ASML, "Equipment for Life Support in Aerospace".

AMFL concurs in this project with the reservation that should Task 6064 advance to the use of chimpanzees in the Biosphere Program, the AMFL should be the source of ASML specimen procurement. AMFL recommends pre-coordination of any test program using primates for simulated or actual space flights.

AMFL requests information concerning the Garrett contract, AF 33(616)-7476. This Laboratory is interested in knowing if the laboratory model from this contract could be available for test use in June or July 1961. Details of the performance capability of the laboratory model are also requested.

7. Project 7222, ASML, "Biophysics of Flight".
Project 7231, ASML, "Biomechanics of Aerospace".
Project 7850, AMFL, "Biodynamics of Flight".

An informal discussion was held on Project 7850.

Both laboratories suggest a meeting of personnel engaged in biodynamic testing be held by Hq AFSC. The purpose of this meeting will be to review existing programs, develop a coordinated biodynamic testing program for the command, assign areas of responsibility in the biodynamics field and discuss proposed new facilities required in the biodynamics testing field.

General Comments:

1. AMFL is concerned about the close-down of WADD's centrifuge and wishes to be kept informed on the availability of this facility. Tentatively, AMFL has scheduled 24 to 36 Project Mercury runs on the centrifuge during the month of June.

2. AMFL wishes to call attention to ARDC Regulation 23-12, dated June 1959, in which the AMFL has been given the responsibility to provide vivarium support to the AF Biomedical R & D Program. In the case of chimpanzees, this Laboratory considers itself the sole source of AF procurement of this species for Biomedical R & D.

3. Previous problems concerning distribution of both laboratory's technical reports was discussed. These problems were resolved with the conclusion that each laboratory will cite the other laboratory on its distribution lists for all published reports. A list of AMFL Reports, 1954 to date, was furnished ASML personnel.

4. Both laboratories recommend coordination meetings preceding the annual project write-ups. It is suggested that a meeting be held in November of 1961 for this purpose while both laboratory's programs are in their initial documentation period.

5. The meeting outlined above was considered extremely valuable to both laboratories concerned.

2-7-6

AFSC

NEWS

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BIOASTRONAUTICS RESEARCH LABORATORY CHIMPANZEE TRAINING PROGRAM

The handling, care, and training of animals at the Air Force Missile Development Center for space biological research is the responsibility of the Bioastronautics Research Laboratory, located at Holloman Air Force Base, New Mexico. In support of its overall mission the Laboratory maintains an animal colony presently numbering more than 100 individual subjects among whom are included dogs, bears, rhesus and java monkeys, and Pan troglodyte chimpanzees. Over half of this colony is composed of chimpanzees.

Pan troglodyte chimpanzees have been found to be in many ways the most ideal animal subject for space medicine research projects because of the physical, metabolical, and temperamental resemblances between Pan and man himself. For example, baseline biochemical studies in urinalysis have shown this connection to be remarkably close. And both physical and intelligence studies have proved the chimpanzee to be far higher on the phylogenetic scale than, for instance, any and all species of monkey.

One of these space biology research projects at the Laboratory which began early in 1958 was known as "Restraint Conditioning of Large Biological Specimens" and contained a purpose that was fourfold: (1) to study the psycho-physiology of young chimpanzees under altered environmental conditions, (2) to test the restraint conditioning possibilities within isolated environments, (3) to teach the subjects a series of conditioned responses under such effects, and (4) to orient the subjects to conditions of actual flight. The details of this project were worked out from theories based on these many man-chimpanzee resemblances, and from large biomedical "question marks" such as just how would Pan (and man himself) react to outer space conditions, isolation, restraint, weightlessness, physical and mental requirements, and flight itself.

In April 1959 the Laboratory was given responsibility of another kind, as overall manager of all animal flights to be launched in connection with the Project Mercury man-in-space program. This came about as a direct outcome of the now expanding original studies in such closely related fields and because of already existing facilities and trained personnel at the Aeromedical Field Laboratory. In fact the Laboratory had already demonstrated by this time, in another program, its ability to evaluate a biological satellite - the Discoverer satellite - in relation to its capacities to sustain life.

Thus the National Aeronautics and Space Administration (NASA) Project Mercury support plan, assigned to the Aeromedical Field Laboratory, called for a number of space trained chimpanzees to be launched in space flight tests to prove the validity of the Mercury capsule system prior to flight by the Mercury astronauts themselves.

-over-

The first of these space flight profiles was accomplished on January 31, 1961 at Cape Canaveral, Patrick Air Force Base, Florida, when Holloman chimpanzee number 65 (chimpanzee HAM as he then became known to all the world) soared 156 miles into space at 5800 miles an hour and was successfully recovered, still in his space capsule, more than 400 miles away on the Atlantic Missile Range - in other words in mid-ocean.

Like all chimpanzees at Holloman currently in space biology programs, HAM got his first name in an entirely informal fashion from his laboratory handlers for no other reason than easy identity. That name, in the beginning, was Chang. Only when he was actually selected from among six of his fellows at Cape Canaveral within a day or so of the flight itself was his name changed to HAM, in honor of Holloman's Aeromedical Laboratory where he received his schooling to become the first "chimponaut" hurled into space. Any of his fellows would have received that sobriquet had they been selected. Thus HAM's official identity in the records of the Aeromedical Field Laboratory is still as "Chimpanzee Number 65" - the registered serial number which, like the number on a soldier's dog-tags, appears in all his clinical records as a means of official and accurate identification.

Another matter as difficult to control or determine as that of "names" is the matter of selection. As with the original seven human Project Mercury astronauts and their final selection, any of the six "chimponauts" sent to Cape Canaveral from Holloman for that first chimp-in-space shot could have been the [illegible] candidate, depending on such variables as health, physical condition, on-the-spot response and other such factors. Taking these variables into consideration and making the final determination by means of every possible physiological and psychological checkup then becomes the responsibility of the small group of Aeromedical Field Laboratory professional doctors and psychologists who are also there "on the spot" for the express purpose of taking care of the animals up to the moment of flight time.

** AEROMEDICAL FIELD LABORATORY STAFF

As a direct necessity of its many and varied space biology research programs the Aeromedical Field Laboratory staff at Holloman has not only crossed many biomedical disciplines but has also found its original small list expanded into a diversified staff of doctors and scientists with a broad capability in space biology fields which has really made it one of the key units of its kind in the Air Force.

Thus the staff currently consists of professional doctors, biologists, flight surgeons, pathologists, veterinarians, physicists, physiologists, psychologists, and astronautical engineers, mostly in the military service but some in civilian status, together with trained medical and veterinary technicians both military and civilian, numbering about 75 individuals in all. About 30 of these individuals have professional degrees in one or more of the above fields.

The care and handling of all animals is the responsibility of AFL's Veterinary Services Branch. The actual training and the development of training techniques and equipment are the responsibility of the Comparative Psychology Branch. The physiological response to unusual environments including the onset of G forces is a study task within the Biodynamics Branch. The evaluation and testing of life support systems and space vehicle systems for human adequacy are the responsibility of the Bio-Astronautics Branch. Together these four branches form the main activity of the Aeromedical Field Laboratory in its biological researches into space flight.

. . . .

(NOTE ** Aeromedical Field Laboratory has been renamed Bioastronautics Research Laboratory as of 1 July 1961.)

Aeromed Jrl 2.7-6

DEVELOPMENT

Young Chimps Destined For Fame As Training Points To Space Flights

Ham and Tiger, two [illegible] chimpanzees, [illegible] themselves to the task of sitting for hours each day in restraint [illegible] tion tests conducted in the interests of space medicine research by AFMDC's [illegible] ecology section, while their trainers (from left), [illegible] Ward, Airmen Charles Watkins and Arnold Lovan, periodically appear on the scene to make observations and record needed data.

Their names are Minnie, Tiger, Elvis and Ham. They're only youngsters, not quite three. All have rounded little bellies, brown eyes, and "old man" faces, showing patiently [illegible]

which man and chimpanzee resemblances—metabolically, physically and temperamentally—could be of practical use in the almost endless problems

each patient little sitter. Here Minnie and her fellow candidates idle for five to eight hours a day, five days a week, with periodic "vacations" and time off at any sign of undue stress.

For the solitary part of the tests the monks are separated from one another by tall masonite board partitions which slide into place to make of each small site a reasonable facsimile of an isolation chamber.

A psychometer work device is another means of adding to the value of the training sessions. This is a metal box about the size of an ordinary suitcase, containing simple instruments which light a panel in front of each chimp, after which the well rehearsed animal pushes a switch to turn the light off.

No Work . . . No Reward

For this hardly arduous, yet needful bit of employment (to measure responses man will have to make during space flight), each small worker is rewarded with a banana or whatever else happens to be his favorite tidbit. However, no work, no reward . . . a system that seems as practical with monkeys as with men.

"This is a job only for men who like animals," Lt Ward explained. "We treat them something like children—no favorites. And of course, all the rules of the American Medical Association with regard to animals are rigidly adhered to. But these chimps are so much like children in ways that we seem to get just as attached to them."

The lieutenant has several co-workers who do most of the actual handling of the animals during the daily training sessions. Airmen Arnold Lovan and

Advanced training activities will be carried out under a comparative psychology branch which has just been established at AFMDC for prolonged chimp training, under the leadership of Maj Frederick Rohles.

Probably such changes will make little difference to Minnie, Tiger, Elvis and Ham. As "space chimps" they have already become veteran students who could hold their own at the top of any class.

Some day in outer space they might have to.

Chimpanzees and personnel involved in [illegible] of the Air Force's [illegible] program [illegible] Richard [illegible] A/1C [illegible] Manuel Moarel [illegible] Roy [illegible] Garwood.

Col Hedrick Transferred

A participant in most of the Air Force's major nuclear test operations,

Young Chimps Destined For Fame As Training Points To Space Flights

[illegible] APMDC [illegible] Ward [illegible]

Their names are Minnie, Tiger, Elvis and Ham. They're only youngsters, not quite three. All have rounded little bellies, brown eyes and "old man" faces. [illegible] the world.

But the world is not ignoring them. Especially the part of it [illegible] outer space. For Minnie, Tiger, Elvis and Ham are chimpanzees being trained for the adventure. Like the seven human astronauts selected for this nation's first manned satellite project—Project Mercury—these four [illegible]

Under the [illegible] Conditioning [illegible] training [illegible] under way [illegible] at AFMDC. [illegible] from Holloman [illegible] Aeromedical Field Laboratory to the [illegible] Laboratory at the University of Kentucky for similar training.

First Such Program

But the first space [illegible] of their kind happen to be Minnie, Tiger, Elvis and Ham. Their training [illegible] in AFMDC's bioastronautics branch, under the leadership of Maj [illegible] D. [illegible] happens to be the first [illegible]

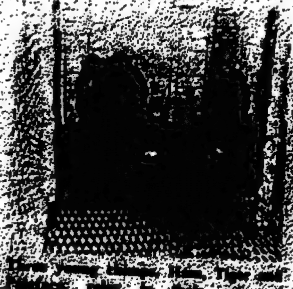
[illegible] Aeromedical Field Laboratory, Lt Col [illegible] Lt William Ward [illegible]

[illegible] physically and [illegible] could be of great [illegible] of space [illegible] research.

Such are they [illegible] the chimpanzee [illegible] an ideal subject to [illegible] of the paths toward outer space.

Space [illegible]

Some of the things Lt Ward and his co-workers [illegible]



[illegible] APMDC [illegible]

[illegible] APMDC for [illegible] the leadership of [illegible] Minnie, Tiger, Elvis [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Col Hedrick Transferred

A participant in many of the Air Force's major nuclear test operations, Col [illegible] R. Hedrick recently left AFSWC for a new position in the space [illegible] office of AFBMD.

In World War II, Col Hedrick served with a [illegible] Bomber Squadron in North Africa, Sicily and Italy. In 1952 he [illegible] his activities with research and testing of nuclear weapons [illegible] Proving Grounds on [illegible] Atoll and at the Continental Test Site in Nevada.

[illegible]

WWI Aerial Dog-Fight Photos Revealed

[illegible]

[illegible]

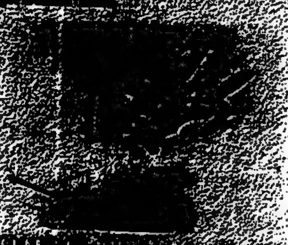
Film [illegible]

[illegible]

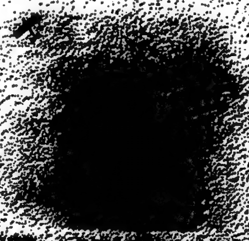
Evidently it was [illegible] plane. [illegible], out of several hundred plates exposed only 57 [illegible] negatives were obtained.

[illegible]

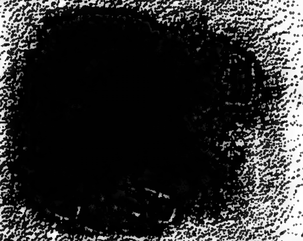
CAUGHT UNAWARE. [illegible]



COLLISION. [illegible]

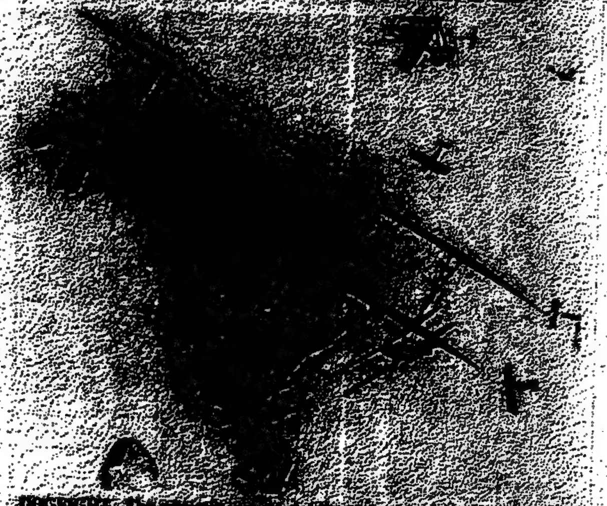


PURSUED. [illegible]



[illegible]

[illegible]



DOGFIGHT. [illegible]

Aeromed Field Lab 2-17-6

HEADQUARTERS
AIR FORCE MISSILE DEVELOPMENT CENTER
AIR RESEARCH AND DEVELOPMENT COMMAND
UNITED STATES AIR FORCE
Holloman Air Force Base, New Mexico

REPLY TO ATTN OF: MDWM

24 June 1960

SUBJECT: FY 60 ARDC Annual Effectiveness Report

TO: MDW (Mr. Bilbo)

1. During FY 60 the Aeromedical Field Laboratory developed improved techniques for human factors track testing procedures and instrumentation, conducted experiments to determine human tolerance to abrupt accelerations, developed methods and procedures for testing biosatellite capsules and components for biological adequacy, maintained conditioned and trained biological specimens for track, chamber, and biosatellite test operations, provided pre and post-test clinical evaluation of test specimens, and coordinated and directed biosatellite test programs. Three projects and one engineering service plan were active during this period: Project 7850, Biodynamics of Flight; Project 6892, Biomedical Tests and Techniques for Advanced Vehicles; Project 6893, Animal Performance in Altered Environments; and ESP 921E 197A 60001, Project Mercury Support.

2. Significant Events and Accomplishments

a. The Aeromedical Field Laboratory was assigned DOD managerial responsibility for the NASA Project Mercury Animal Program. A program protocol was written which NASA Space Task Group approved; and a van complex to support launch and recovery operations was designed by laboratory personnel and fabricated by NASA. Laboratory personnel designed a psychomotor performance program and provided technical assistance to McDonnell Aircraft Company in the design of a psychomotor programmer for the animal flight couches. Chimpanzee centrifuge tests were conducted at Wright-Patterson Air Force Base combining oscillation, vibration and accoustical noise parameters encountered in flight, and chimpanzees were trained to perform psychomotor performance tasks in mock-ups of the Project Mercury capsule. Chimpanzees have been sufficiently trained for flights one and two since February 1960.

b. The Comparative Psychology Branch was activated in August 1959. At the present time, this Branch has one of the finest facilities in the country for measuring animal behavior and is the only unit of its type in the Air Force. A capability exists for training mice, rats, pigeons, monkeys of all sizes, and chimpanzees for space flight. Most noteworthy has been the training of a mouse to press a lever 100 times for one pellet of food for twenty minutes every six hours for four days in a completely unattended situation. Complex training procedures have been successfully accomplished with rats and both Java and Rhesus monkeys are currently working on difficult discrimination tasks. Chimpanzees have been trained to press a lever to avoid noxious stimuli in mock-up space capsules, and most impressive is the performance of a chimpanzee on an oddity problem. The animal had to select the odd symbol from a three-display situation in which two of the symbols were alike and one was different. In one session, the subject made 3,000 of these selections in 56 minutes with only eight mistakes.

c. In October 1959, the Biodynamics Branch was manned and became an active unit of the Laboratory. Over 250 deceleration experiments were performed on the Daisy Decelerator and Bopper. The experiments were designed to investigate human tolerance to abrupt deceleration, development of aircraft and space vehicle personnel equipment and in support of other Laboratory activities. Of the 250 tests, 85 were with human volunteers, five with animal subjects, 64 for instrumentation and [illegible] checks, 46 for special tests of the B-58 ejection capsule, the [illegible] and Project Mercury and 35 for the Laboratory Underwater Deceleration program. Underwater experiments were performed on the Daisy Decelerator with blocks of wood, small dummies, and fish to determine the physical and physiological effects of a fixed volume in an abrupt G field. Information from these tests was used in programming the test on the 35,000 foot Captive Missile Test Track of AFMDC. Six tests were performed with the Norair designed and built fluid filled capsule which has a man-carrying capability.

d. Considerable progress was made in the development of a single unit radiation monitoring system which will provide a biologically significant radiation monitor for space flight. Two radiation detection devices were developed under contract with the Laboratory. These are a primary cosmic particle detector which will detect particles with $Z > 6$ and a detector which is sensitive to gamma radiation, neutrons, electrons, protons, and alpha particles. A feasibility study of a detection system utilizing designs such as are incorporated in the two available systems was completed. After complete testing of the two systems, development and fabrication of a single miniaturized system can be initiated, to provide one complete unit suitable for satellite flights. A contractual study has been in progress to establish the relative biological effectiveness of energetic particulate radiations which can be produced in laboratories. Incorporation of these RBE values into the single unit radiation monitoring system will provide a biologically significant radiation monitor for space flights.

e. A significant increase in bioelectronics support capability was noted during this period. Numerous new electronic instruments were procured which allow more specialized measurements to be made. One very significant bioelectronic item procured during this period is a physiological data acquisition system which was developed by Gulton Industries. This system is capable of measuring several physiological parameters including EKG, blood pressure, heart rate, GSR, respiration, and skin and rectal temperature. This data can be telemetered from an airborne package and read-out in digital or analog form at the ground receiving station.

f. The Laboratory acquired an air gun propulsion device for the Daisy Decelerator which has a design capability of propelling a 2,000 pound sled at 175 f/sec. This device will increase the control over sled velocities and provide greater accuracy and freedom in programming deceleration patterns in respect to onset characteristics and durations.

g. The Laboratory significantly increased its capability to pursue more sophisticated ecological and animal performance studies by procuring a closed environmental system from the General Electric Corporation. This system is capable of maintaining temperatures from 50° to 100° F with a 2° F tolerance at any level, monitoring 30% to 98% relative humidity, and maintaining 130 to 760 mm mercury absolute pressure. Atmospheric composition can be altered to meet needs of experiments.

h. A series of tests were conducted to determine the biomedical adequacy of the Mark II Discoverer life cell. Detailed countdown procedures were published as Directorate of Advanced Technology Technical Memorandum and were used by BMD to establish launch countdown procedures.

i. A significant improvement in the areas of nutrition, care and clinical management has occurred during this period, as well as an improved capability for pre and post-experiment zoological clinical evaluation. This has been brought about by progress in the interpretation of baseline physiological data, including electrocardiology, dental eruption schedules, and the addition of a biochemical capability which allows for greater expansions in the field of normal and abnormal body fluid collection and interpretation.

j. A continuing series of tests were accomplished to determine the overt emotional response and the physiological response of chimpanzees to aircraft flight (one G). Physiological data has been successfully telemetered to ground receiving stations during three flights. One item of note is the fact that some chimpanzees are initially susceptible to motion sickness, but this susceptibility decreases as the specimen's flight time increases.

k. A continuing series of tests were accomplished to determine the overt emotional response and physiological response of chimpanzees to various temperature and humidity conditions during twenty hour test periods. Data from those tests indicate that the upper limits for a non-working chimpanzee, in the defined test parameters, is 90-95°F and 50% relative humidity.

l. The Viability Data Acquisition, Handling, Storage, Reduction, Display and Recalli System (VIDAT System) concept was developed to the point that a contract has been let for a feasibility and design study. The VIDAT System concept is best described in two parts. First, it is felt that the present technology within the United States is capable of providing equipment that can determine most of the interrelationships between one or more organisms and their environment. The Air Force has need of equipment to obtain this information from small, closed ecological systems for space flight. Second, it is felt that a logically evolving family of VIDAT Systems, designed to meet specific Air Force advanced research objectives is the most feasible measure to secure the needed biomedical data in its best form.

3. The assignment of a C-131 B aircraft to the Center solely to support the Laboratory has alleviated a major problem of timely aircraft support for the chimpanzee aircraft flight program, pick-up and delivery of animals and Project Mercury. This aircraft will be instrumental to specifically support Laboratory experiments.

4. Major problem areas remaining are:

a. The lack of a laboratory building designed to support aeromedical applied research programs has resulted in reduced effectiveness of assigned personnel in supporting the laboratory mission. The increasing complexity of problems associated with space flight and the dire need for immediate answers to these problems dictates that a proper facility be provided if the Air Force expects to make timely progress in space programs. A new building is programmed in the FY 62 budget.

b. The problem of obtaining an adequate number of healthy, immature chimpanzees suitable for training and space flight experiments has increased twofold during the past year. The purchase of chimpanzees from stateside vendors has proved entirely unsatisfactory and it has become necessary to schedule yearly trips to Africa to obtain a suitable number of animals which meet our rigid experimentation standards. The loss of a veterinary officer and two veterinary technicians during this yearly trip considerably reduces the Laboratory capability to support Air Force programs.

c. Recognition of this Laboratory's capability in its assigned mission areas has resulted in a greater demand for support of Air Force and national programs. This has resulted in an increased workload which cannot be accomplished in a timely manner until additional manpower spaces are allocated to the Laboratory. A staff study has been initiated outlining this problem area in detail.

Hamilton H. Blackshear

For

RUFUS R. HESSBERG
Lt. Colonel USAF (MC)
Chief, Aeromedical Field Laboratory

D
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T

~~SECRET~~

~~AMFL ANIMAL CONDITIONING~~

~~The Aeromedical Field Laboratory of AFMDC is acting as overall manager of the animal program in NASA Project Mercury. The major objective of this program is to develop methods, techniques, and procedures for determining the biomedical adequacy of the Project Mercury manned capsule. Chimpanzee's physiology, biochemistry, and performance will be studied prior to, during, and post launch. A dynamic verification of ground, flight, and recovery procedures will be made.~~

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If ~~Enclosure~~ Attachment No. 1
is withdrawn (or not attached), the classification of this correspondence will be cancelled.

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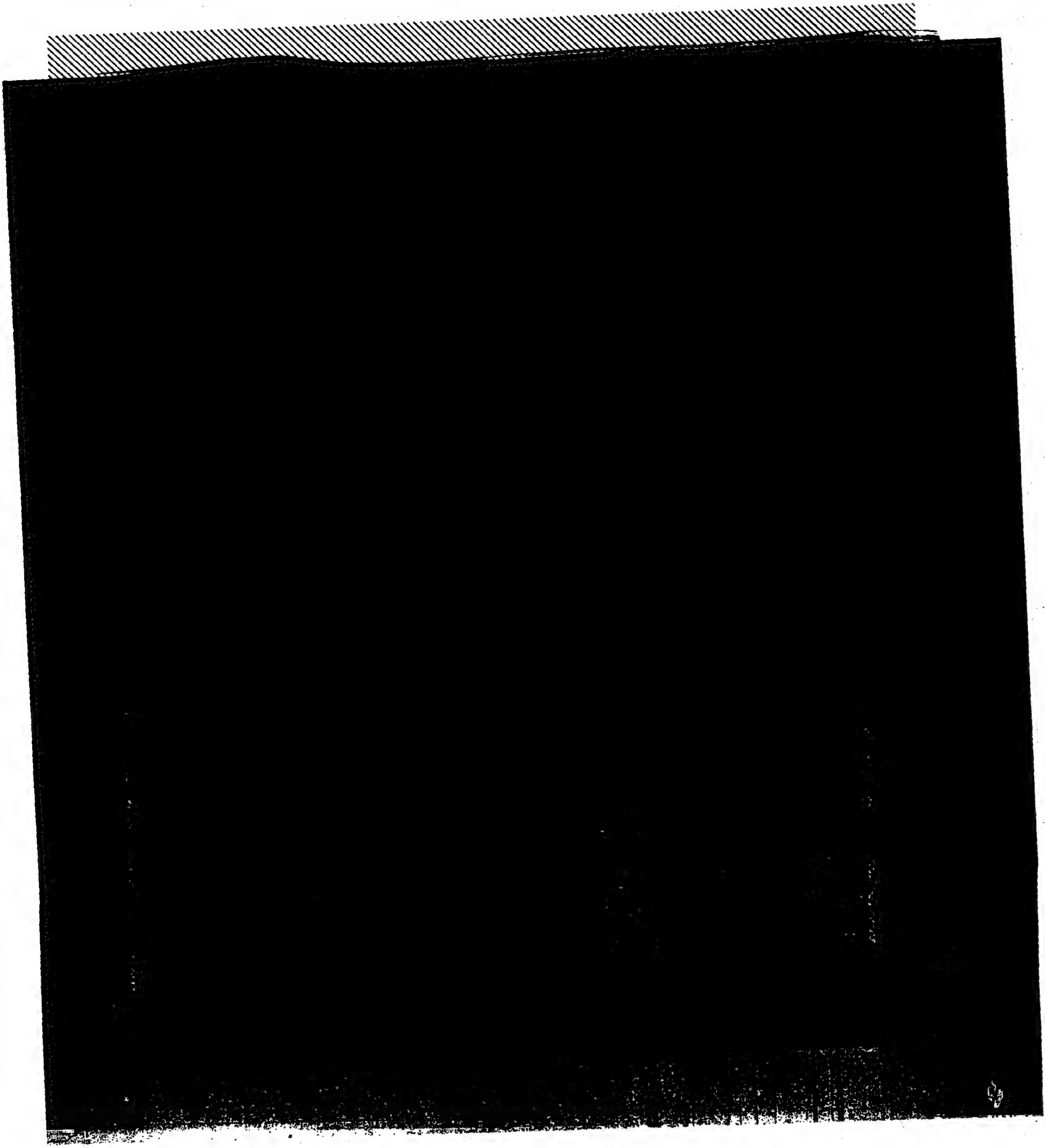
The information contained in this documen
not be disclosed to foreign nationals or
representatives.

~~RESTRICTED DATA~~
ATOMIC ~~ENERGY ACT 1954~~

~~SECRET~~



UNCLASSIFIED

[illegible] AF-R55(01)
(ANSWER TO LTR DATED 13 APRIL 1960)

AF-R55(CT)

1. 680 CONTRACTS

		CONTRACT FUNDS
7850	Biodynamics of Flight	FY 60 10
78503	Tolerance to Impact Forces	
AF29(600)-2038	University of Illinois	

Purpose: To determine movement of animal internal organs during abrupt deceleration by rendering these organs radio opaque to high speed X-rays. The Daisy Decelerator is the device required to obtain these abrupt decelerations and is a unique facility. Results are applicable to the Air Force mission and are disseminated to outside agencies.

2. 680 CONTRACTS

		CONTRACT FUNDS	
7850	Biodynamics of Flight	FY 58 100	FY 60 50
78503	Tolerance to Impact Forces		
AF29(600)-1494	University of Chicago		

Purpose: To serve as a propulsion device for Daisy Decelerator. A wide variety of sled velocities will be obtained thus permitting full utilization of the unique Daisy Decelerator. Testing results applicable to Air Force mission and disseminated to other agencies.

3. 680 CONTRACTS

		CONTRACT FUNDS	
7850	Biodynamics of Flight	FY 59 85	FY 60 22
78503	Patterns of Deceleration in Space Flight		
AF29(600)-1815	Northrop Aviation Inc.		

Purpose: To determine human tolerance to short term decelerations with the subject immersed in a fixed volume of water. The Air Force Missile Development Center Captive Missile Test Track must be used as the test facility in order to obtain [illegible] short [illegible] and to [illegible] the spiked curves of space vehicle launch. Results applicable to Air Force mission and disseminated to other agencies.

4. 680 CONTRACTS

CONTRACT FUNDS

7850 Biodynamics of Flight FY 60
25

78503 Tolerance to Impact Forces

AF29(600)-2384 Barnes and Reinecke Inc., Chicago, Ill.

Purpose: This new water brake will permit 100% utilization of the unique Daisy Decelerator for studying all of the parameters effecting human tolerance to impact forces. [illegible] will be compatible with the existing Daisy Decelerator. Results applicable to Air Force mission and disseminated to other agencies.

5. 680 CONTRACTS

CONTRACT FUNDS

7850 Biodynamics of Flight FY 58 FY 59 FY60
45 9 6

78504 Tolerance to Abrupt Pressure Changes

AF29(600)-1675 American Machine and Foundry

Purpose: To determine tolerances to rapidly applied changes in pressure up to ten atmospheres. This program supports others in progress at this organization (under water deceleration) and thus should be done by this organization. Results applicable to Air Force mission and disseminated to other agencies.

6. 680 CONTRACTS

CONTRACT FUNDS

7850 Biodynamics of Flight FY 61

[redacted]

78503 Tolerance to Impact Forces

Contractor unknown

Purpose: To increase capability of the unique Daisy Decelerator by increasing the length of the track to permit safe use of the full velocity range of the new propulsion device. Will become an integral part of existing Air Force equipment.

[illegible] of Deceleration
in Space Flight

Contractor unknown

Purpose: To develop and fabricate a high G, multi-purpose flat-top sled for use on the Air Force Missile Development Center, Captive Missile Test Track. To be used with the underwater deceleration program, subject carrying oscillator and other unforeseeable large items requiring high G short term deceleration testing. Thus by supporting existing programs and facilities the requirement is laid on the Air Force. Results applicable to Air Force mission and disseminated to other agencies.

11. 680 CONTRACTS

CONTRACT FUNDS

6892 Bio-Astronautics FY 59
17

68921 Altered Environments for Biological Specimens

AF29(600)-2017 University of California

Purpose: To determine the resistance of [illegible] animals to high ambient partial pressures of [illegible] and to low ambient partial pressures of [illegible]. [illegible] determined to be necessary during [illegible] MARK I life support system [illegible] Air Force [illegible]. Only the Air Force can state the test parameters of interest. These parameters are based on models of expected environmental conditions in life support systems developed for the Air Force.

12. 680 CONTRACTS

CONTRACT FUNDS

6892 Bio Medical Test & Techniques for Advanced Vehicles FY 60
91

68925 Biological Dosimetry of Ionizing Space Radiations

AF29(600)-2361 Lockheed Aircraft Corporation

Purpose: To develop a radiation detection system capable of detecting and analyzing the following space radiations: gamma rays, electrons, neutrons, protons and alpha particles. This system combined with one designed for analyzing heavy primary cosmic particles (AF29(600)-[illegible]) will provide almost complete coverage of those radiations presently thought to exist in space. This work should be contracted for and monitored by the Air Force because of the direct application to human factors problems of manned space weapons systems.

13. 680 Contracts

CONTRACT FUNDS

6892 Bio-Medical Test & Techniques FY 60
for Advanced Vehicles 2[illegible]

68926 Biological Dosimetry of
Ionizing Space Radiations

AF29(600)-2049 Lockheed Aircraft Corporation

Purpose: To accomplish a feasibility study on the development of a space radiation monitor [illegible] to all types and energies of space radiation. [illegible] places may [illegible] unknown [illegible] utilize [illegible] with [illegible] a [illegible] AF29(600)-[illegible] and AF29(600)-[illegible]. [illegible] AF29(600)-2049 should be [illegible] by the Air Force because of its [illegible] of the [illegible] under other Air Force contracts and because of the direct application to human factors problems of manned space weapons systems.

14. 680 CONTRACTS

CONTRACT FUNDS

6892 Bio-Medical Test & Techniques FY59 (FY60)
for Advanced Vehicles [illegible]

68926 Biological Dosimetry of
Ionizing Space Radiations

AF29(600)-2759 University of Chicago

Purpose: To develop a detection and analysis system for primary cosmic radiation within the following limitations: Z = 6 - 30, Energy - 100 MEV - 10,000 MEV. A detection device such as this is necessary in ascertaining the types and intensities of primary cosmic particles in space. Such a system will undoubtedly comprise a part of a more sophisticated over-all space radiation monitoring system to be developed in the future. This work should be contracted for by the Air Force because of the direct application to human factors problems of manned space weapons systems.

[illegible]

[illegible] balloon flights [illegible] a cosmic particle detector [illegible] -1749) and the nuclear emulsions [illegible] tion of the detector. Since the detector development was accomplished under Air Force contract and [illegible] was natural and [illegible] feasible to accomplish [illegible] this detector under Air Force contract.

16. 680 CONTRACTS

[illegible]

6892 Bio-Medical Test & Techniques FY 60
for Advanced Vehicles [illegible]

68926 Biological Dosimetry of
Ionizing Space Radiations

AF29(600)-2340 Controls for Radiation

Purpose: To establish the Relative Biological Effectiveness of corpusculate radiations (electrons, protons, alpha particles and particles with Z greater than 6) within the energy range of 40 - 750 MEV. This information is necessary for incorporation into a space radiation monitoring system, (see Contract AF29(600)-2049), so that a biological dose rate may be established. This work should be accomplished under Air Force sponsorship so that continuity of a space radiation detection and evaluation program can be maintained and because of direct application to problems of manned space weapons systems.

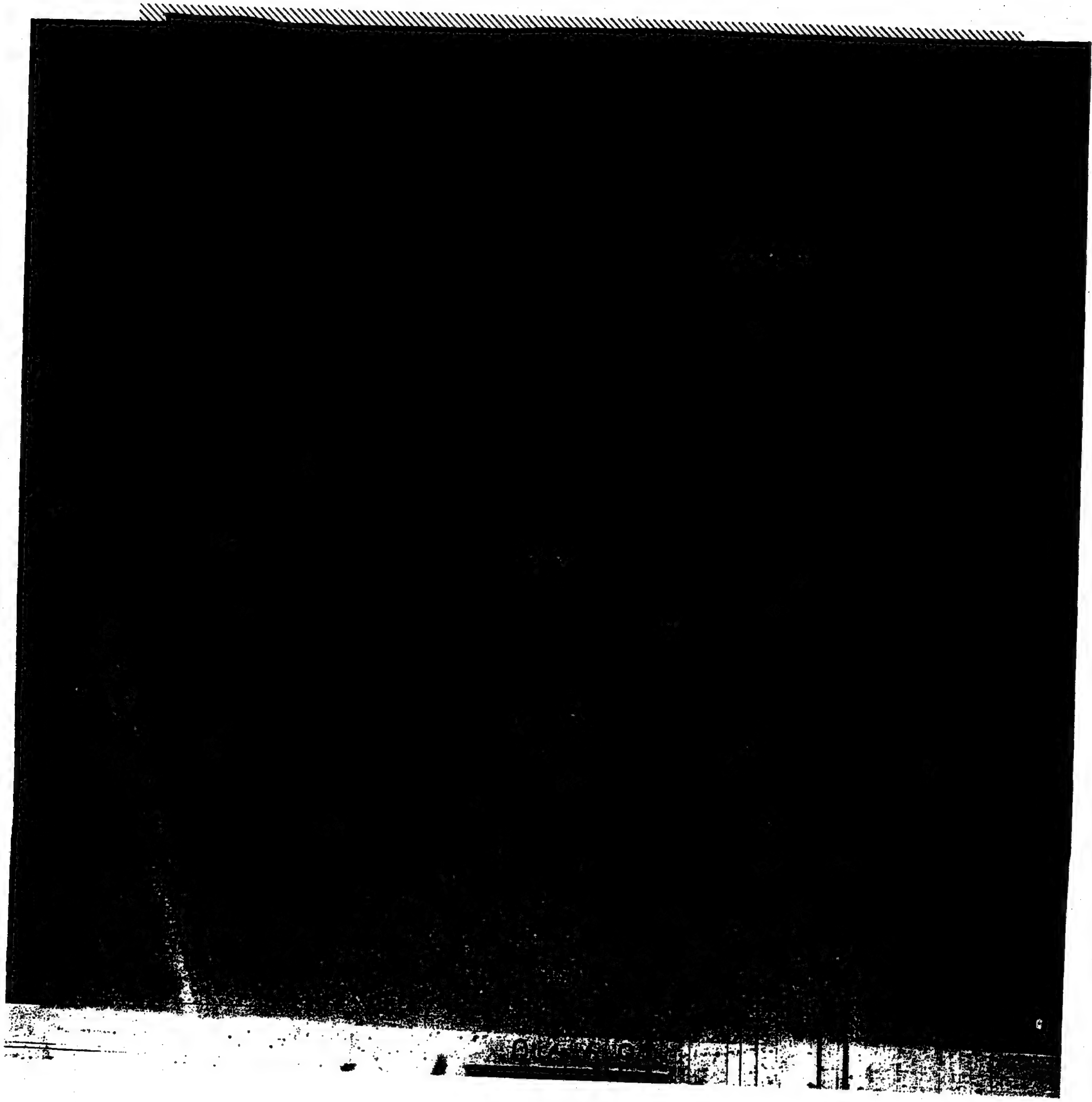
17. 680 CONTRACTS

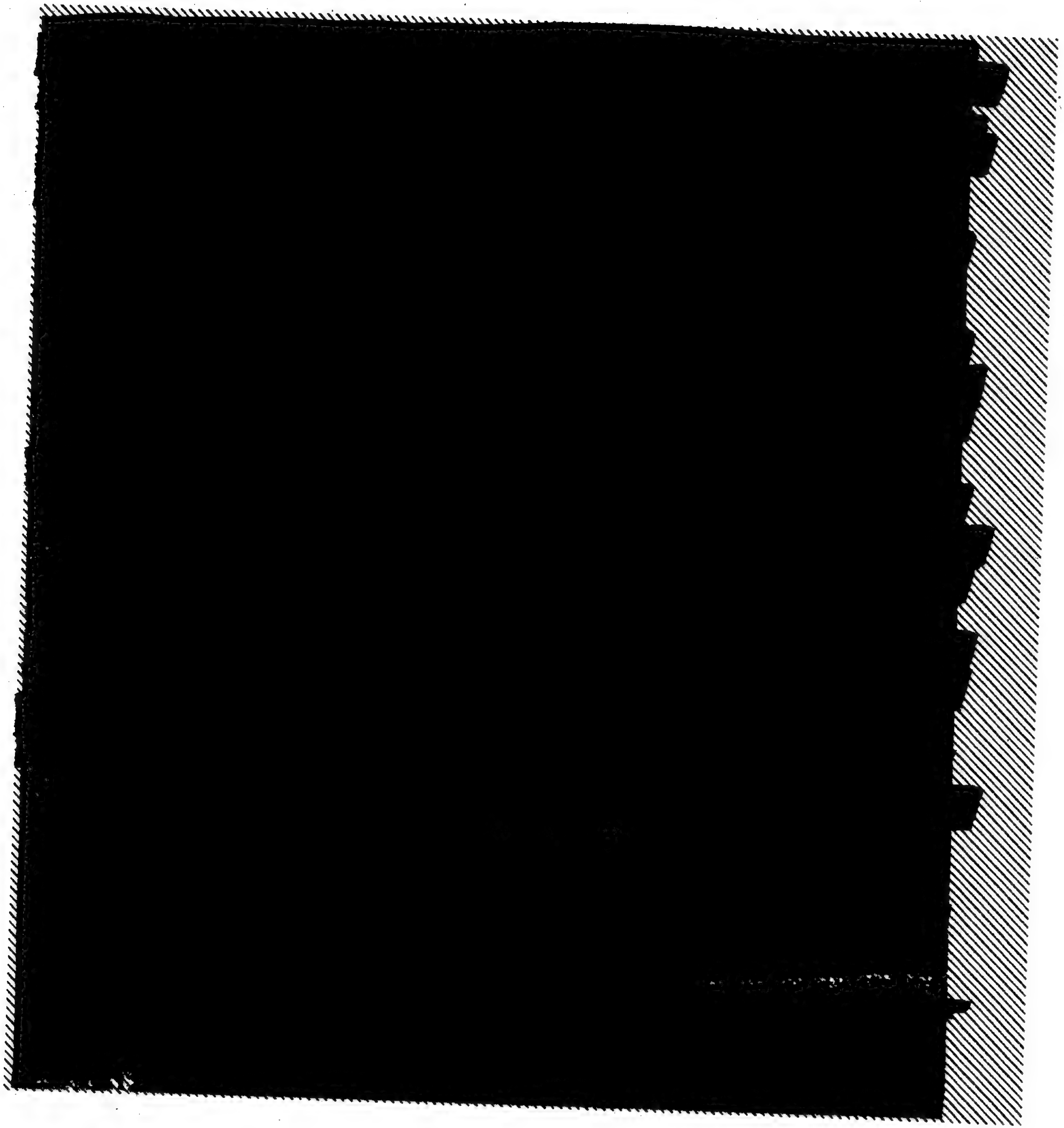
[illegible]

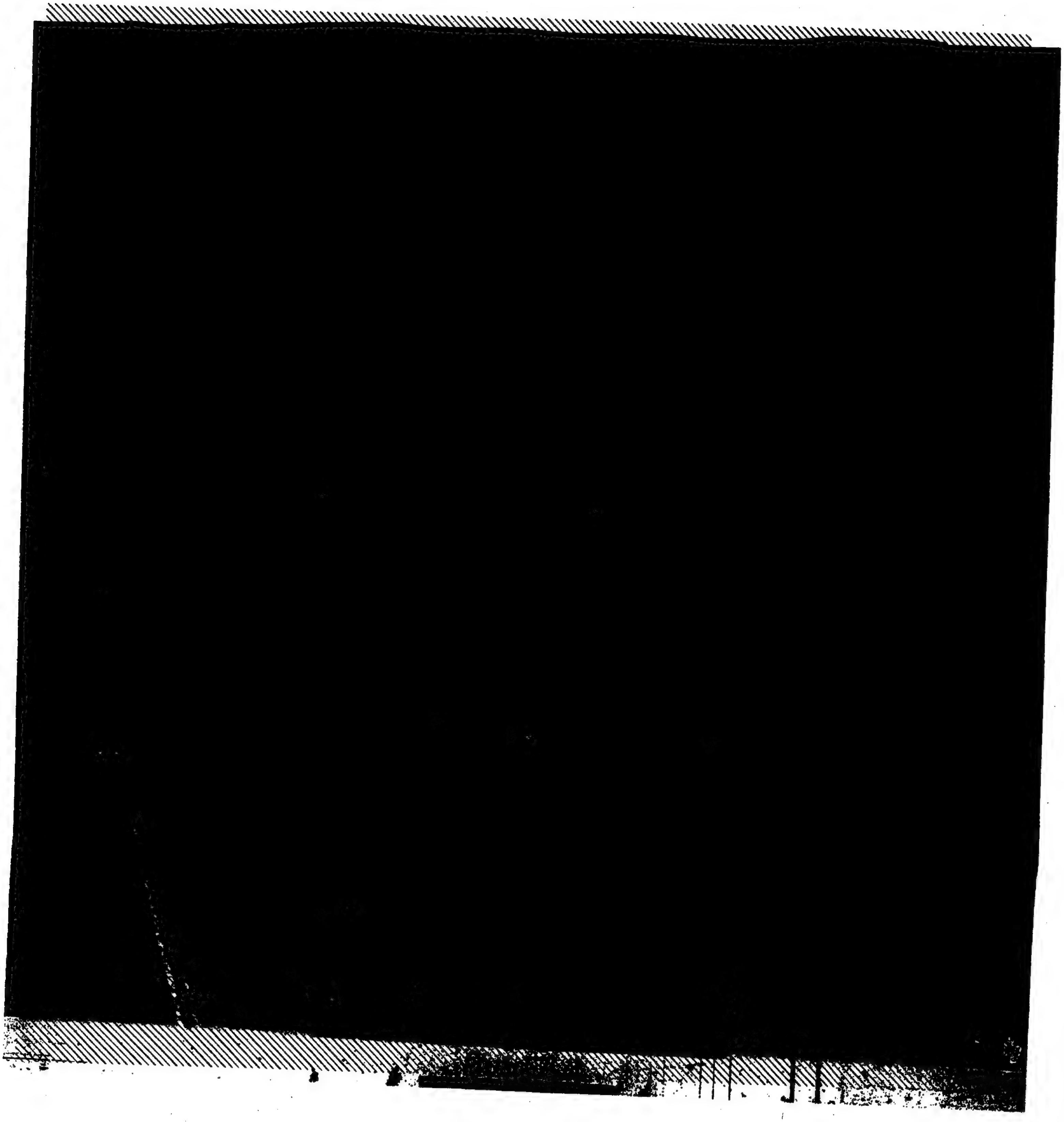
6892 Bio-Medical Test & Techniques FY 61
for Advanced Vehicles

68920 Biological Specimen Support

Contractor Unknown







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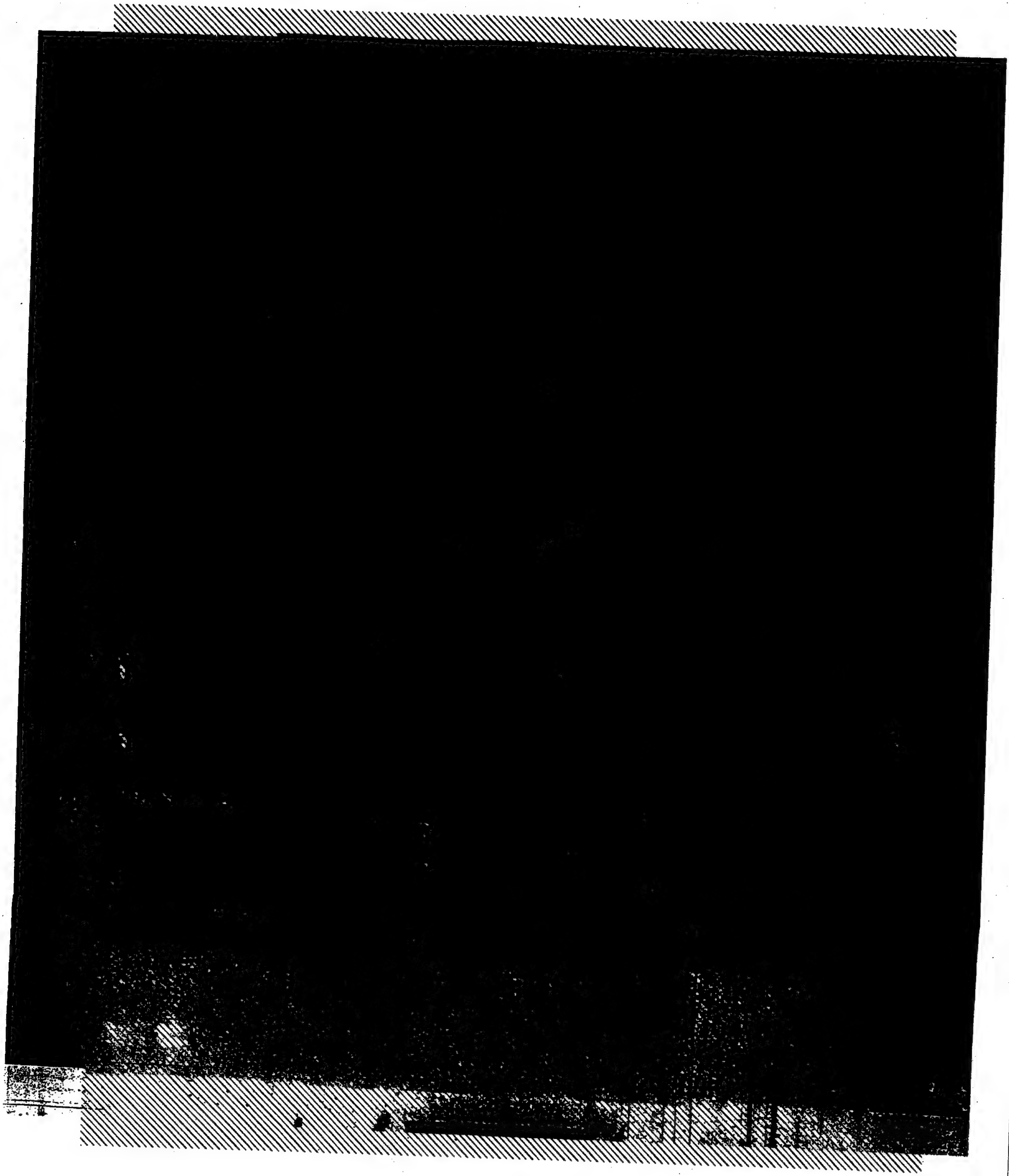

1-1-2-24-5 / Aeromed Field Lab
15 May 196

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UNITED STATES AIR FORCE
Holloman Air Force Base, New Mexico

U. S. AIR FORCE -- AEROSPACE POWER FOR PEACE

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FACT SHEET

ANIMAL TRAINING AT THE AEROMEDICAL FIELD LABORATORY FOR PROJECT MERCURY

"TRAINING PREPARATIONS"

The handling and care of animals used at AFMDC in aeromedical research begins in the Aeromedical Field Laboratory's Veterinary Services Branch.

The Veterinary Services Branch is divided into two sections, the Vivarium Section and the Pathology Section. The Branch as a whole consists of pathologists, veterinary doctors, and highly trained veterinary and laboratory technicians responsible mainly for the care and conditioning of animals for biomedical research dealing with space flight problems.

The Vivarium section is responsible chiefly for the housing, care, feeding, medication, and recreation of these animals. At present about 400 animals representing eight different types are housed in this section.

One type of animal involved in these large-scale continuing research programs is Pan troglodyte the chimpanzee. Because of physical, temperamental, and metabolical resemblances to man, Pan has proved to be an ideal subject for many problems dealing with space medicine research.

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When AFMDC's Aeromedical Field Laboratory was assigned the task of supporting the NASA (National Aeronautics and Space Administration) Project Mercury manned space flight program by providing trained chimpanzees for space flight, the chimpanzees already in training at Holloman for related biomedical tasks became of vital importance to the Mercury project.

At the Air Force Missile Development Center's Aeromedical Field Laboratory the rules of the American Medical Association with regard to the care and treatment of animals are rigorously enforced. This requirement has set the sequence of events through which all the animals are taken before leaving the Veterinary Services Branch for any special tasks. For the Project Mercury support tasks this sequence which takes place every working morning in handling the chimpanzees deviates from basic handling routines only in certain special features connected with clothing and equipment used for the project.

Thus Pan and all his fellows first receive a light breakfast at seven-thirty. This is a prescribed breakfast of prepared chimp chow with perhaps a grapefruit or orange as a special treat. Each chimp may also get a fresh cool cup of liquid gelatin then or a bit later - but the intent still, as with human workers, is to save the main meal for later in the day.

Breakfast takes place in the cage area; afterward, each animal is brought to the Vivarium examination room for a thorough physical checkup. This consists of taking his temperature, measuring pulse and respiration rates and blood pressure, checking teeth, ears, eyes, and daily weight. Daily clinical charts are kept for each animal. If the weight is off-normal or any other parameters disclose undue signs - for instance if body temperature is over 101 degrees - the subject is sent off to the "hospital" section for isolation and further examination and treatment.

By eight-thirty in the morning most of those ready for a busy training day

-more-

are being led to other rooms to be clothed or prepared for special tasks. For the Mercury training project this consists of fitting the younger and newer subjects with nylon vests to be worn for restraint purposes as they sit through isolation and psychomotor response tests, or fitting the more advanced students with somewhat more elaborate nylon suits to be worn while they recline in their specially designed "Mercury couch" capsules during the rest of the work day as they go through various response and stimulus tests.

The more elaborate nylon suits - informally dubbed "space suits" in the same way that the Mercury chimps have been informally dubbed "chimponauts" - are laced into place around their wearers within 15 to 30 minutes.

By nine-thirty each morning during working days the busy preparations at the Vivarium with this special group of chimpanzees has simmered down and each "chimponaut" is on his way elsewhere in a heated panel truck for his training day while the rest of the work at the Vivarium - including hygiene, base line studies, treatment, and support of other research projects with other animal species - goes on.

By three-thirty in the afternoon the training day is usually over for the Mercury chimps and back they come to the Vivarium. Here they are again taken to the examining room for a general physical which includes - but is not necessarily limited to - weight, temperature, heart, and respiration checkups, all clinically recorded as before.

At this time they are ready for their main meal of the day. This meal, which generally takes place around four o'clock, consists of staple prepared chimp chow, favorite kinds of fruit, and a high-protein specially-prepared drink composed of pabulum, jello, eggs, and milk.

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From this period until the next "duty call" the Chimponauts, like their less advanced fellows in other Aeromedical activities, are free to disport in their cage homes and "take their leisure" just as any good workingman does after his daily labors.

SIDE-BARS

1. On one occasion during the rides from the Vivarium in the panel truck a talented Chimponaut named Ham worked the lock loose at the truck's back door and then spent the time waving sociably to every passing car - until one motorist signaled the panel truck's driver. After that the lock was changed to fit on the outside.

2. At the end of each training day some Vivarium attendants can be seen industriously washing out each Chimponaut "space suit" like any washerwoman in the back yard - then hanging them out to dry.

2-7-6

1. ☐ ACTION REQUIRED ☐ CHANGE ☐ SIGNIFICANT EVENT ☒ RESULTS

MANAGEMENT REPORT

☐ SYSTEM ☐ PROJECT ☐ TASK ☒ ENGINEERING SERVICE

2. REPORTS CONTROL SYMBOL: [illegible] D-1

3. PAGE 1 OF 2 PAGES

DATE: 12 January 1960

NUMBER: 921E 497A 59012

AFMDC - MDMW

Applied Research
780 B

4. TITLE: School of Aviation Medicine Bio-Pack

7. RESP ORGN: AFMDC

8. PARTICIPATING CENTERS: SAM

10. PARTICIPATION/COORDINATION/INTEREST: SAM, Brooke AFB, Texas (P)

11. TECHNICAL GROUP: HF

12. APPLICABLE AREAS

A. ☐ TECHNICAL B. ☒ TEST C. ☐ FUNDS D. ☐ MATERIEL E. ☐ FACILITIES
F. ☐ MANPOWER G. ☐ PERSONNEL H. ☐ TRAINING I. ☐ CONTRACTS J. ☐ AIRCRAFT

13. NARRATIVE

This Management Report is written to report completion of ESP number 921 E 497A 59012, "School of Aviation Medicine Bio-Pack."

a. Termination Date: 29 May 1959 Captive Missile Test Track run.
12 June 1959 Daisy Track run.
29 June 1959 Daisy Track run.
30 June 1959 Vibration table.
1 July 1959 Vibration table.

b. Authority: Letter from Chief of Staff to Commander Air Research and Development Command dated 10 April 1959, requesting that appropriate Air Research and Development Command Centers support wherever possible the School of Aviation Medicine Bio-Pack Program.

c. Objective of Plan: The Captive Missile Test Track run of 29 May 1959 and the Daisy Track run of 12 June were done to check the adequacy of the Bio-Pack attach brackets and the capsules capability to hold pressure. The Captive Missile Test Track run was done to simulate a two spike launch curve with peaks of 10 "G". The Daisy Track runs were done to simulate a water impact of 40 "G". The Daisy Track run of 29 June was done to test the biological adequacy of the entire system to this impact. Two vibratory tests were run. One test of 10 to 500 cycles with one "G" and one test at 10 to 500 cycles with 10 "G".

d. Results: Attachment brackets were not damaged and the item did not leak after the Captive Missile Test Track and Daisy Track runs. No damage occured to the Bio-Pack on the one "G" vibration test. During the 10 to 500 cycles, 10 "G" vibration test one of the six outer mounting brackets cracked, the internal structure became bent, the water bottle jarred loose and the camera footage indicator dented the outer shell.

e. Contract Funds Expended: None

f. Disposition of Remaining Resources: Returned to School of Aviation Medicine.

g. Reports Written: None. Data was forwarded to School of Aviation Medicine.

ARDC FORM 1 JUL 58 111 PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE.

1. ☐ ACTION REQUIRED ☐ CHANGE ☐ SIGNIFICANT EVENT ☒ RESULTS

MANAGEMENT REPORT

☐ SYSTEM ☐ PROJECT ☐ TASK ☐ ENGINEERING SERVICE

2. REPORTS CONTROL SYMBOL: ARDC D-15

3. PAGE 2 OF 2 PAGES

4. DATE: 12 January 1960

5. NUMBER: 921E 497A 59012

4. TITLE: School of Aviation Medicine Bio-Pack

6. PREPARING AGENCY: AFMDC - MDRM

7. RESP ORGN: AFMDC

8. PARTICIPATING CENTERS: SAM

9. PROGRAM STRUCTURE: Applied Research 780 B

10. PARTICIPATION/COORDINATION/INTEREST: SAM, Brooks AFB, Texas (P)

11. TECHNICAL GROUP: HF

12. APPLICABLE AREAS

A. ☐ TECHNICAL B. ☒ TEST C. ☐ FUNDS D. ☐ MATERIEL E. ☐ FACILITIES

F. ☐ MANPOWER G. ☐ PERSONNEL H. ☐ TRAINING I. ☐ CONTRACTS J. ☐ AIRCRAFT

13. NARRATIVE

SUBMITTED BY:

ELI L. BEEDING, JR.
Captain, USAF, MSC
Project Officer

DATE: 8 Jan 1960

AUTHENTICATED BY:

HERBERT W. SIMMONS
Major, USAF
Chief, Programs Division
DUS/Operations

DATE: 13 Jan 60

Aeromed file

MDWMC (Major [illegible])

17 December 1959

Request for Working Space

DGS Installations

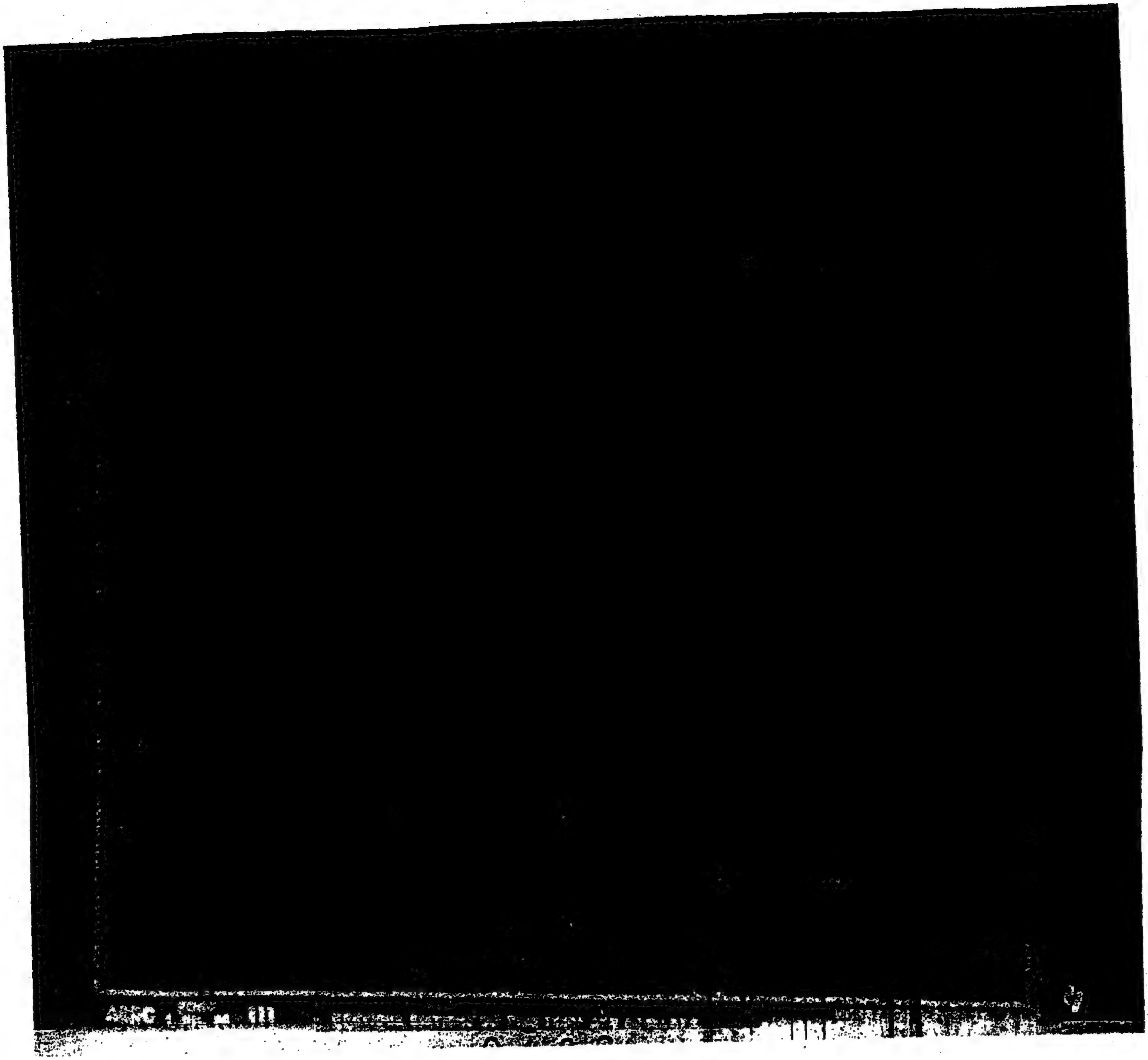
1. The Comparative Psychology Branch of the Aeromedical Field Laboratory is conducting research with chimpanzees to determine the effects of exposure to space environment on performance. At present these animals are housed in the Vivarium Branch, a distance of [illegible] miles from the Comparative Psychology Branch. This means that in order to conduct [illegible] personnel from the Psychology Branch [illegible] the animals from the vivarium, transport them to the Psychology Branch [illegible] to the vivarium at the [illegible]. This [illegible] from the time that could [illegible]. The ideal plan would be to have the testing and housing of the animals in close geographical proximity. In most laboratories with which I have been associated, animals are issued to the using unit which then assumes the responsibility for their care, housing, and feeding.

2. Such an arrangement is impossible in the Comparative Psychology Branch because it does not have sufficient space to both house and test the animals. In turn, the Vivarium Branch does not have sufficient space to absorb the research conducted by the Psychology Branch.

3. The Psychology Branch is presently occupying approximately 2500 sq. ft. in Bldg. 1266. This is to request a facility having 4500 sq. ft. Failure to provide this branch with this space will seriously curtail its research effort.

RUFUS R. HESSBERG
Lt. Col., USAF (MC)
Chief, Aeromedical Field Laboratory

Copies to:
Dr Millsap - MDGB
Col Cobb - MDW



2-7-6-1 Regs

The Aero Medical ~~[illegible]~~ Laboratory, Wright Air Development Center and the Aviation Medical Acceleration Laboratory, ~~[illegible]~~ Naval Air Development Center have investigated the effects of prolonged deceleration of subjects while immersed in water. It is believed that human tolerance to prolonged "G" forces could be greatly increased if the subject is completely surrounded by a fluid medium. What would be "G" forces out of the fluid become pressure per square inch due to the incompressibility of water.

To complement these studies the Bio-Astronautics Branch of the Aeromedical Field Laboratory has initiated studies of human tolerance to abrupt deceleration while the subject is immersed in water. The first question that had to be considered was what direction the immersed subject would move, during deceleration if he moved at all. Opinions where divided. Some said forward, some said back, others up, others down and some said it wouldn't move at all. Lt. Albert Zaborowski, Task Scientist, using a small water tank is investigating this problem on the "Bopper" and Daisy Track. Small blocks of wood and small biological specimens are being decelerated.

In May of this year a large tank, built by Northrop Aircraft Company, will be delivered for use on the Captive Missile Track. This tank is large enough to carry human subject but before these volunteers can be exposed the problems of subject movement, communications, and respiration, however must be solved. Respiration is the greatest of these problem.

1. ☐ ACTION REQUIRED ☐ CHANGE ☐ SIGNIFICANT EVENT ☒ RESULTS

MANAGEMENT REPORT

☐ SYSTEM ☒ PROJECT ☐ TASK ☐ ENGINEERING SERVICE

2. REPORTS CONTROL SYMBOL: ARDC D-15

PAGE 1 OF 3 PAGES

3. DATE: [illegible] October 1959

[illegible]

4. TITLE

Biodynamics of Flight

7. RESP ORGN: AFMDC

[illegible]

10. PARTICIPATING [illegible]

Aero Medical Laboratory, WADC (1) [illegible] (1)

School of Aviation Medicine [illegible] (1) AFMDC (1)

12. APPLICABLE [illegible]

A. ☐ [illegible]

F. ☐ [illegible]

15. NARRATIVE

This [illegible]

contract [illegible]

Task: [illegible]

[illegible]

Track, [illegible]

1957 and [illegible]

use on [illegible]

basis [illegible]

Task: [illegible]

Work [illegible]

System, [illegible]

3 December [illegible]

built and [illegible]

dynamic [illegible]

Task: [illegible]

Work [illegible]

Garment, [illegible]

was com[illegible]

tective [illegible]

Task: [illegible]

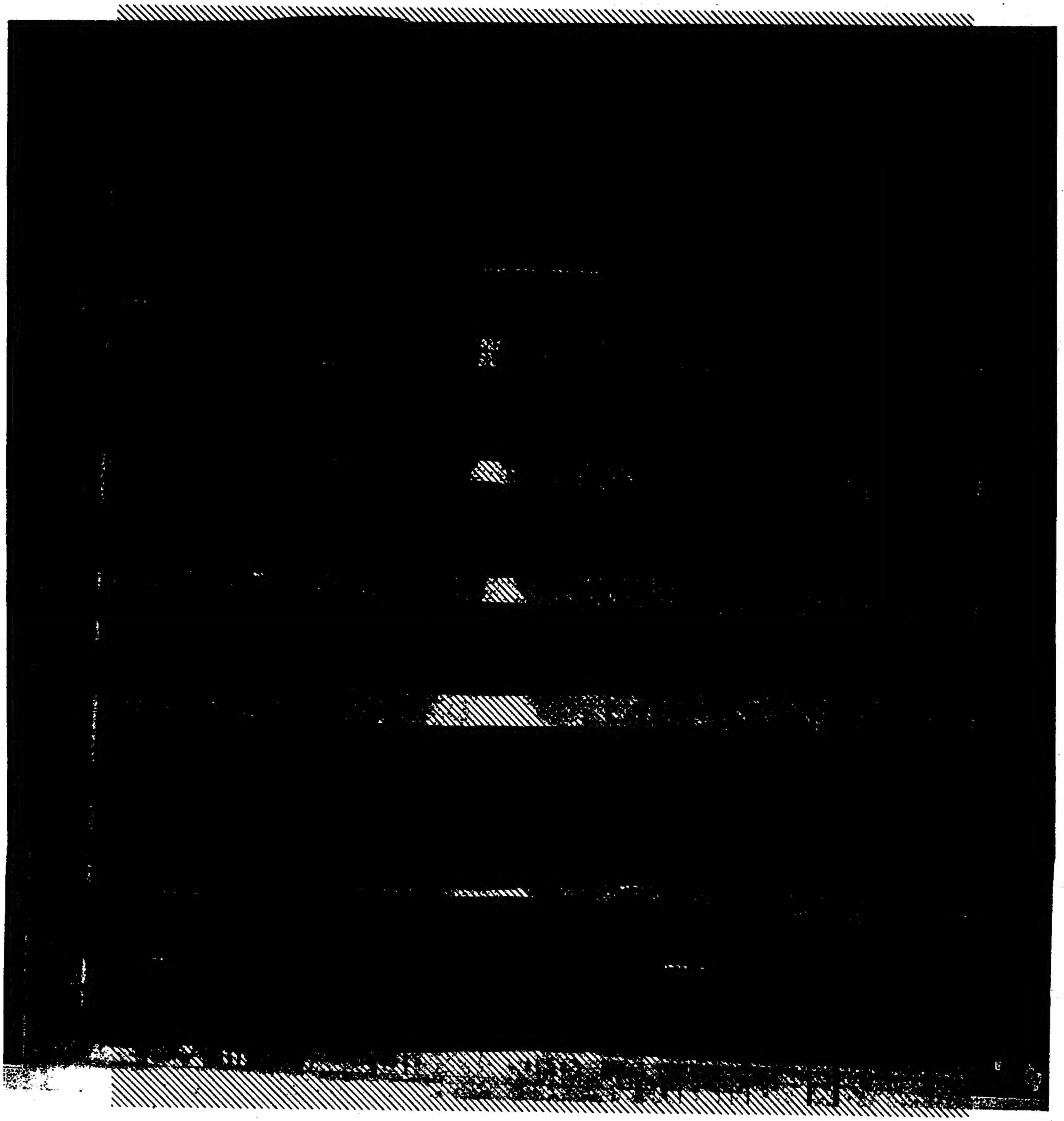
[illegible]

Work has [illegible]

Laboratory [illegible]

starting [illegible]

ARDC [illegible]



☐ PERSONNEL   ☐ TRAINING

[illegible] With [illegible] type of operation the [illegible] on a regularly scheduled basis. This is [illegible] this base be assigned to support Aeromedical Field Laboratory [illegible] will continue until a pressurized aircraft [illegible] Center primarily to support the Aero[illegible] a continuing need for Base Fabrication [illegible] of restraint are developed. Service in this [illegible] requires constant monitoring. The loss of two key [illegible] the part [illegible] and the anticipated loss of another NCO in one month's time [illegible] no programmed replacement [illegible] serious limitations on future plans [illegible]. The conditioning portion of this task and the [illegible] transferred to the Comparative Psychology Branch of the [illegible] September 1959.

4. Future Plans: It is anticipated that base-line studies of environmental parameters, i.e. temperature and humidity tolerances, [illegible] and hypoxia tolerances, will be initiated in the near future. Progress [illegible] these efforts will depend on availability of certain AMDC facilities such as the low pressure chamber (Stratosphere) and thermal chamber as well as personnel.

JOHN D. MOSELY, Major, USAF, MC
Project Officer

DATE: 29 Sept 1959

[illegible] H. S[illegible]MONS, Major, [illegible]
Acting Chief, Program Division, [illegible]
[illegible]/Operations

DATE: 2 Oct 1959

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